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AMERICAN MACHINIST

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Improved Adjustable Bolt Cutter.

In former issues we have illustrated and described the Adams bolt cutter, and it will be remembered that the head of the machine is so constructed that two opposite portions of it, working on large sliding surfaces, carry the cutters which are opened and shut by the action of pins, which are offset in such a way as to act as cams. The head as thus made is well adapted to work that is to be produced in large quantities of uniform size, but the head which we now illustrate, and which is founded upon the Adams head, retaining its valuable features, is at the same time adapted to work which requires to be frequently changed in size—such work, for instance, as is found in many railroad, boiler and jobbing machine shops. The present machine is known as the Cook Automatic Bolt Cutter, and is so arranged that, by simply turning a graduated ring at the back of the head, the dies are adjusted for any desired variation from the nominal diameter, this adjustment not interfering in the least with the regular automatic opening and closing of the head. The added function is performed by a ring which on one side takes the form of a scroll, and engages with four blocks which are placed behind each of the four jaws, these blocks moving in milled slots, as shown. In these blocks the pins, one of which is shown and designated in the sectional view, Fig. 3, has a bearing within a steel bush, as shown. The opening and closing pins are operated by the movement of the back plate, their engagement with this being by means of radial slots, which allow of adjustment by the ring and blocks.

The dies are as simple as they can well be, being nothing more than plain pieces of steel fitted to the holders, and secured by screws under which buttons are placed, to avoid disturbing the position of the dies in tightening. The dies can be hobbed in dummy heads, and finished ready for use before being put into the machine.

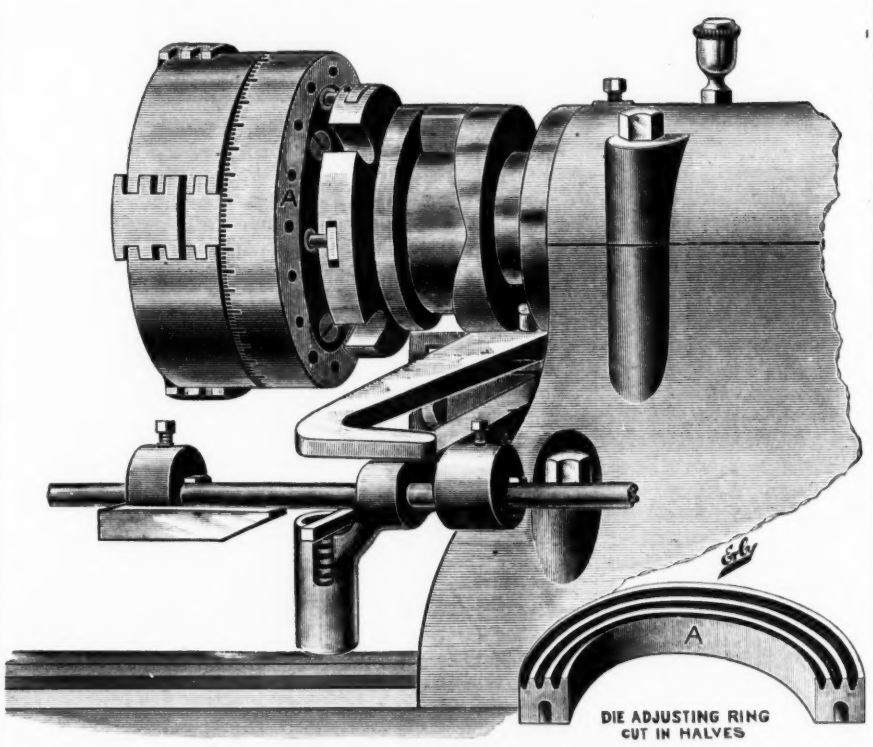
The automatic closing and opening device is substantially the same as has been heretofore illustrated, the carriage coming into contact with adjustable collars causing the head to open, closing being effected by returning the carriage to its place. Some improvements have been made in this also, calculated to increase its wearing qualities particularly.

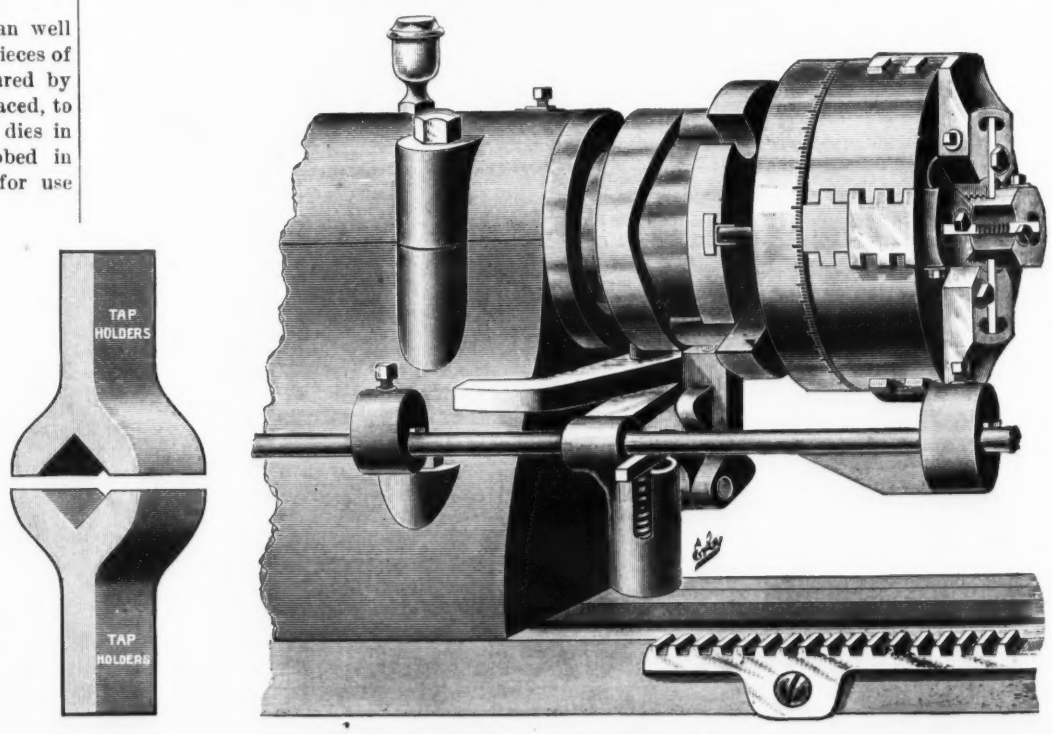
All parts of the head are of steel, and it is so arranged that no chips can possibly get into it.

The dies are so made that, when put into the head and pushed back as far as they will go, they will cut their nominal size when the adjusting ring is set at zero, movements of one graduation either way from this varying the size by .001", so that any desired definite variation in size can be secured.

Dies can be changed without loss of time, and in tapping, the tap holders shown are put in place of the dies, and held in the same manner.

They are made in all sizes, from the smallest, fitted for threading bicycle spokes, to machines adapted for bolts 3½" diameter, by the Capitol Manufacturing Co., Chicago, Ill.





IMPROVED ADJUSTABLE BOLT CUTTER.

The *Evening Post* has been having one of its periodical conniption fits, because the great city of New York pays its laborers the highest rates of wages, instead of bearing the labor market by hiring them at the lowest possible prices.

The Baltimore & Ohio Railroad will make an exhibit at the World's Fair showing the history and development of railways from their beginning to the present time. In pursuance of this purpose it has sent a representative to London to prepare models of the chief objects of the many in the Kensington Museum relating to railways. There is every indication that the Department of Transportation will be the most complete thing of the kind ever seen.

Melting Cast-iron in Cupolas.

BY S. BOLLAND.

I.

The cupola is now one of the most important factors in foundry economy. Its management commands the attention of the founder to a far greater extent to-day than it has ever done in the past. No matter what pains may be taken to insure a good and safe mold, every attempt in that direction will be neutralized if the molten iron supplied for filling it is not, in every sense, up to that standard of excellence which a right use of the materials employed warrants us to expect.

The truth of the above has been so often demonstrated, that any further allusion to the fact would be superfluous here. The science of melting in cupolas seems to have made very slow progress, until it was seen by some of the advanced thinkers on the subject that there was "money in it"; then the services of the engineer and scientist were enlisted in the cause, and specialists in the manufacture of cupolas and blowers were to be found everywhere.

A result of this change in the order of things is that, instead of working, as has hitherto been the case, by the "rule of thumb," we are now enabled to measure, with a degree of accuracy almost marvelous, the air, fuel, capacity of cupola, and pressure of blast, etc., required to melt a given quantity of iron in a specified time. True, we do not always accomplish this with the degree of accuracy above spoken of, but in nearly every case of failure the cause may be traced to the non-fulfillment of the known conditions.

It must be remembered that the intelligence of the melter has not grown with the steady improvements now being established in nearly all of our leading establishments, consequently it requires the constant attention of foreman or manager to insure a correct manipulation of improved cupolas and their adjuncts.

The thoughtful founder has profited to an appreciable extent by reason of the claims for recognition made by the manufacturers of cupolas and blowers, for in order to substantiate such claims they have flooded the market with catalogues and pamphlets, which contain an elucidation of the science of melting such as cannot be found anywhere else.

This literature, made purposely plain, has been read extensively with very good results, a better feeling has been established between the workman and the scholar, and there is now no doubt in the mind of the practical founder that the day of mystery is past, for very much, if not all of the mystery has been scattered by those very scholars whom he has always been taught to despise.

The good resulting from this improved education in matters relating to the melting of iron in cupolas is nowhere seen to better advantage than in the erection and management of what may be called the common cupola, which, notwithstanding the immense number of patent ones sold, still finds a place in every land, and, I suppose, always will. It must strike the interested observer that, after all, there is not very much difference in the construction of cupolas. Most of the so-called "improved" have made their debut within the last thirty-five years, and very many of them have, after a short trial, been changed back to the old style, with considerable profit to those interested.

Others are simply "tolerated" because they are neither better nor worse than the old style, and not a few of the really meritorious cupolas are producing minimized results from the simple cause that there is not sufficient intelligence expended on their management. In a number of cases, when the

formulas furnished by the patentees for guidance in the management of their cupolas are followed to the letter, very excellent results ensue, both time and money being saved by adopting them; but as these formulas are carefully prepared by experts, and are, in the main, reliable, we need not inquire into their respective merits, but proceed at once to an exposition of the construction and management of the common cupola, for, on account of the extra cost of erection, joined to the strict management required for the successful working of most patent cupolas, there will, I presume, always be a demand for the former.

The blast furnace, in some form or other, has always had a place in the metallurgical arts, and dates back to the earlier dynasties of the ancient empire of Egypt; true, they were very simple contrivances, but that which was accomplished is made to appear all the more wonderful in view of their simplicity. The Catalan furnace is a type of some of these old-time smelting processes, and, primitive as they were, could be found in use in some parts of Europe a few years back; these were simply a hole in the ground, with walled sides, into which a copper tuyere pipe penetrated. When the charcoal and ore had been properly placed within this hole, the blast was forced through the tuyere pipe by some of the antiquated methods then in vogue, until the molten iron was produced.

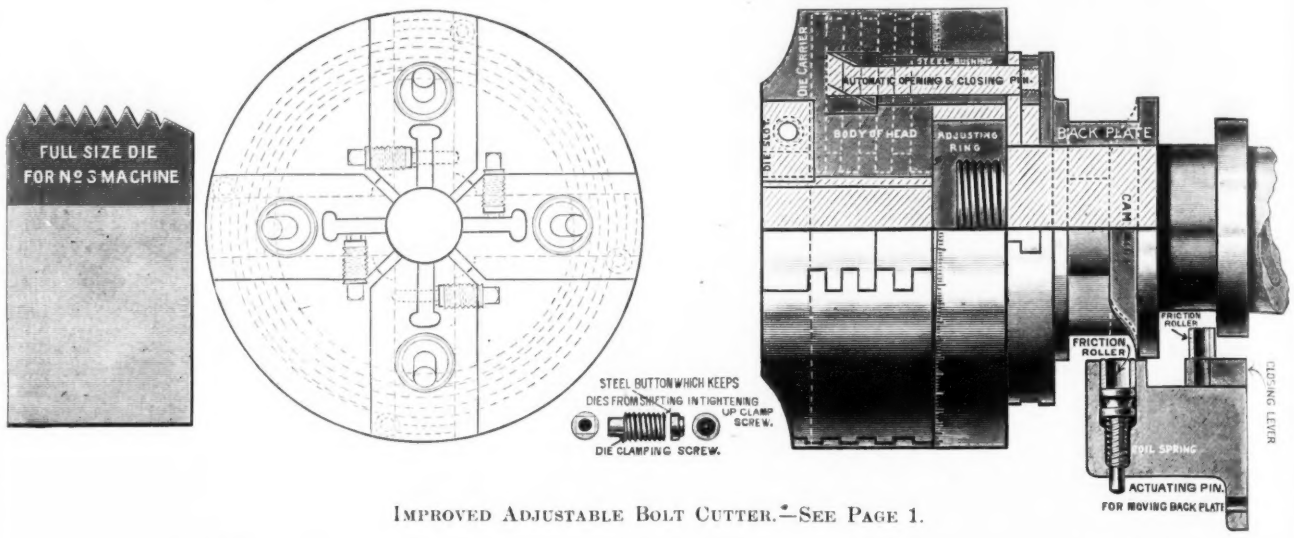
At Fig. 1 will be seen a longitudinal vertical section of the Catalan furnace, which, as will be observed, has no chimneys. On the left of the figure is seen the lower part of the tromp or blowing engine; the blast is produced by means of a fall of water of about twenty-five feet through a tube into the cistern below, to whose upper part the blast pipe is connected, the water escaping through a pipe below. This apparatus is on the outside of the building, and is said to afford a continuous blast of great regularity.

Now, if we continue the walls of this primitive contrivance, what do we obtain in reality other than the cupola of to-day, exact in every particular, so far as the principles involved for melting iron are concerned?

Fig. 2 shows sections and elevation of what was considered a good type of cupola fifty years ago, and of which type there are large numbers still working in England and other parts of the European continent, as well as still a few in some of the remote parts of this country. There is really no essential difference betwixt the cupola shown at Fig. 2 and that seen at Fig. 3, except that, instead of the bottom resting on a solid foundation, as at Fig. 2, the one at Fig. 3 is supported by four columns *A*, which allows for the dropping out of the whole contents of the cupola at once, swing doors *B* being provided for that purpose, whilst in the former case the cupola, when done working, must be raked out with hooks through large apertures *A* provided for the purpose.

Another feature which commands attention is the substitution of a wind box round the cupola, connecting with a system of pipes above, for the underground arrangement shown at *B*, *B*, Fig. 2; this allows for the multiplication of tuyeres or any other changes which experience may suggest, being made with very little trouble or expense.

A careful examination of Fig. 3, aided by the table which accompanies this article, will enable any one to build a cupola after the pattern shown, which pattern is, to all intents and purposes, what we may call a common cupola, in contradistinction to all such as are protected by letters patent.



IMPROVED ADJUSTABLE BOLT CUTTER.—SEE PAGE 1.

TABLE

SHOWING HEIGHTS, DEPTH OF BOTTOM, QUANTITY OF FUEL ON BED, PROPORTION OF FUEL AND IRON IN CHARGES, DIAMETER OF MAIN BLAST PIPES, NUMBER OF TUYERES, BLAST PRESSURE, SIZES OF BLOWERS AND POWER OF ENGINES, MELTING CAPACITY PER HOUR, AND TOTAL MELTING CAPACITY OF ALL CUPOLAS FROM 24 INCHES TO 84 INCHES IN DIAMETER.

Diameter of Cupola inside of lining, in Inches.	Height of Cupola from bottom plate to bottom of charging door, in Feet.	Depth, from sand bed to under side of tuyeres, in Inches.	Amount of Fuel required on bed, in Pounds.	First charge of Iron, in Pounds.	Succeeding charges of Fuel, in Pounds.	Succeeding charges of Iron, in Pounds.	Diameter of Main Blast Pipe when not exceeding 100 feet in length, in Inches.	Number of Tuyeres 6 inches diameter required for each Cupola designated.	Number and Dimensions of flat Tuyeres equivalent to the 6-inch round ones.		Blast Pressure required in Ounces.	Sizes of Root Blower, designated by their number.	Horse-Power of Engine to drive Root Blower.	Sizes of Sturtevant Blower, designated by their number.	Horse-Power of Engine to drive Sturtevant Blower.	Melting Capacity per hour, in Pounds.	Total Melting Capacity, in Pounds.
Inches	Feet	Inches	Pounds	Pounds	Pounds	Pounds	Inches	No.	No.	Dimensions	Ounces	No.	H.-P.	No.	H.-P.	Pounds	Pounds
24	10	10	300	900	50	500	10	1.5	2	10″ x 2″	6	2	5½	2	1	1,500	6,000
26	10	10	390	1,170	92	828	10	2.2	2	14½″ x 2″	6	2	5½	2	1	2,000	8,000
28	10	10	480	1,440	134	1,206	10	2.6	3	12½″ x 2″	6	2	5½	2	1	2,500	10,000
30	12	10	570	1,710	176	1,584	12	2.6	3	12½″ x 2″	7	3	8	3	2	3,000	12,000
32	12	10	660	1,980	218	1,962	12	3.3	4	12″ x 2″	7	3	8	3	2	3,500	14,000
34	12	10	750	2,250	260	2,340	12	3.3	4	12″ x 2″	7	3	8	3	2	4,000	16,000
36	12	10	840	2,520	302	2,718	14	3.7	4	13½″ x 2″	8	4	11½	4	3	4,820	18,280
38	12	10	930	2,790	344	3,096	14	5	6	12″ x 2″	8	4	11½	4	3	5,640	22,560
40	13	10	1,020	3,060	386	3,474	14	5.	6	12″ x 2″	8	4	11½	4	3	6,460	25,840
42	13	10	1,110	3,330	428	3,852	16	5.8	6	11½″ x 2½″	10	5	17¾	5	5½	7,550	30,200
44	13	10	1,200	3,600	470	4,230	16	5.8	6	11½″ x 2½″	10	5	17¾	5	5½	8,640	34,560
46	13	10	1,290	3,870	512	4,608	16	6.8	6	13½″ x 2½″	10	5	17¾	5	5½	9,730	38,920
48	13	10	1,380	4,140	554	4,986	18	6.8	6	13½″ x 2½″	12	5	17¾	6	9¾	10,760	43,040
50	14	10	1,470	4,410	596	5,364	18	8.	8	11½″ x 2½″	12	6	27	6	9¾	11,790	47,060
52	14	10	1,560	4,680	638	5,742	18	10.7	8	15½″ x 2½″	12	6	27	6	9¾	12,820	51,280
54	14	10	1,650	4,950	680	6,120	20	10.7	8	15½″ x 2½″	14	6	27	7	16	13,850	55,400
56	14	10	1,740	5,220	722	6,498	20	12.2	8	17½″ x 2½″	14	6	27	7	16	14,880	59,520
58	14	10	1,830	5,490	764	6,876	20	12.2	8	17½″ x 2½″	14	6	27	7	16	15,910	63,640
60	15	10	1,920	5,760	806	7,254	22	13.7	8	16½″ x 3″	14	6	27	8	22	16,940	67,760
62	15	10	2,010	6,030	848	7,632	22	13.7	8	16½″ x 3″	14	7	40	8	22	18,340	73,360
64	15	10	2,100	3,300	890	8,110	22	15.4	8	18½″ x 3″	14	7	40	8	22	19,770	79,080
66	15	10	2,190	6,570	932	8,388	22	15.4	8	18½″ x 3″	14	7	40	8	22	21,200	84,800
68	15	10	2,280	6,840	974	8,766	22	17.1	10	16½″ x 3″	14	7	40	8	22	22.630	90.520
70	16	10	2,370	7,110	1,016	9,144	22	19.	10	18½″ x 3″	14	7	40	8	22	24.060	66,240
72	16	10	2,460	7,380	1,058	9,522	24	19.	10	18½″ x 3″	16	7	40	9	35	26,070	104,280
74	16	10	2,550	7,650	1,100	9,900	24	23.9	12	16½″ x 3½″	16	Special for these sizes.	Increase of power to suit Blower	9	35	27,980	111,920
76	16	10	2,640	7,920	1,142	10,278	24	23.9	12	16½″ x 3½″	16			9	35	29,890	119,560
78	16	10	2,730	8,190	1,184	10,656	24	26.	12	18½″ x 3½″	16			9	35	31,800	127,200
80	16	10	2,820	8,460	1,226	11,134	24	26.	12	18½″ x 3½″	16			9	35	33,710	134,840
82	16	10	2,910	8,730	1,268	11,412	24	28.	14	17″ x 3½″	16			9	35	35 620	142.480
84	16	10	3,000	9,000	1,310	11,790	26	31.	16	16″ x 3½″	16			10	48	37.530	150,120

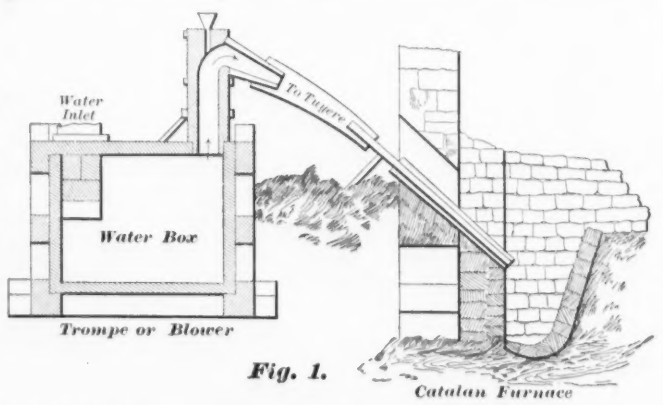
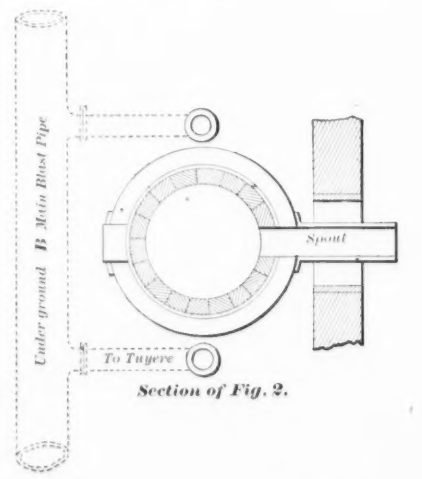
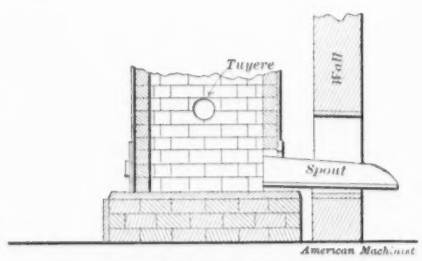


Fig. 1.



Section of Fig. 2.



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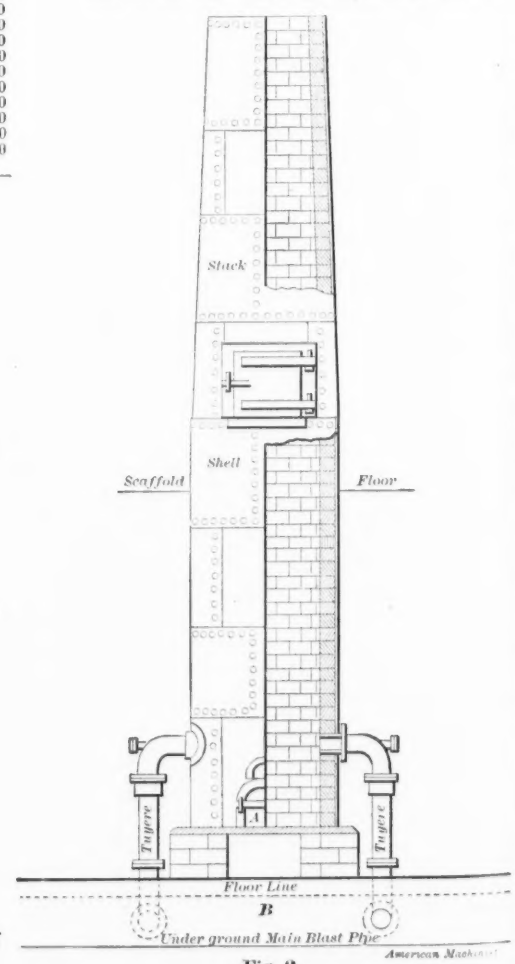


Fig. 2.

Let us now consider in detail the various requirements for the erection and management of such a cupola.

LOCATION OF CUPOLA.

What shall be its capacity, and where shall it be located? are very important points to be considered. With regard to the latter query, due care should always be exercised to choose a location which will be equidistant from all its parts, for, whether the iron is carried in shanks, run on trucks, or changed from crane to crane in ladles, this disposition will give an equal and rapid distribution.

A very good axiom is that of Mr. Kirk's, who, in his very excellent work, "Founding of Metals," says: "It is easier to wheel pig-iron to a cupola than it is to carry molten iron away from it."

CAPACITY OF CUPOLA.

The accompanying table will be of service in determining the capacity of cupola needed for the production of a given quantity of iron in a specified time.

First, ascertain the amount of iron which is likely to be needed at each cast, and the length of time which can be devoted profitably to its disposal; and supposing that two hours is all that can be spared for that purpose, and that ten tons is the amount which must be melted, find in the column, Melting Capacity per hour in Pounds, the nearest figure to five tons per hour, which is found

to be 10,760 pounds per hour, opposite to which, in the column, Diameter of Cupolas' Inside Lining, will be found 48 inches; this will be the size of cupola required to furnish ten tons of molten iron in two hours.

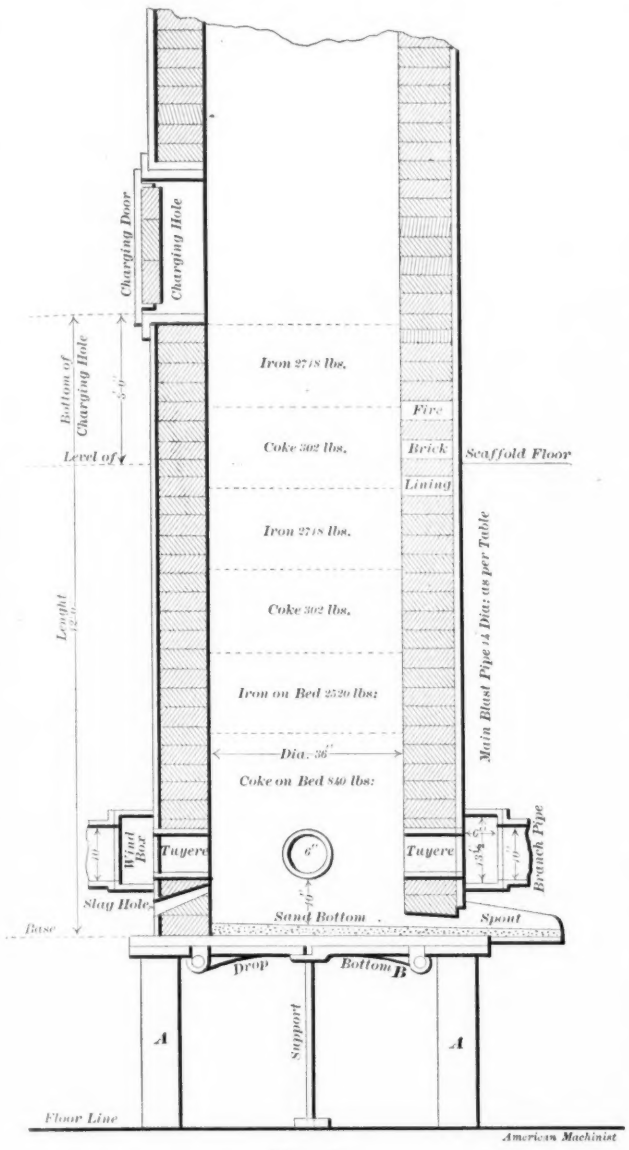


Fig. 3.

MELTING CAST-IRON IN CUPOLAS.—SEE PAGE 1.

Or suppose that the heats were likely to average six tons, with an occasional increase up to ten, then it might not be thought wise to incur the extra expense consequent on working a 48 inch cupola, in which case, by following the directions given, it will be found that a 40 inch cupola would answer the purpose for 6 tons, but would require an additional hour's time for melting whenever the 10-ton heat came along.

Let it be understood that the quotations in the table are not supposed to be all that can be melted in the hour by some of the very excellently equipped cupolas now in the market, but are simply the amounts which a common cupola under ordinary circumstances may be expected to melt in the time specified.

HEIGHT OF CUPOLA.

What is meant by height of cupola is the distance from the base to the bottom side of the charging hole.

Height in cupolas is important, as all low cupolas lose a considerable amount of combustible gas which escapes unburnt, whereas when a sufficient height is allowed a large quantity of this gas mixes with the oxygen above and ignites, thus giving off heat available for combustion.

Should it be required to know what height to make a 50-inch cupola, find 50 inches in the column, "Diameter of Cupolas," opposite to which, in the column, "Height of Cupola" from base to bottom side of charging hole, will be found 14 feet, so that a 50-inch cupola should have a height of 14 feet.

The height of any other cupola from 24 inches to 84 inches diameter may be found in the same manner.

Friction Clutch Pulley.

With this we give illustrations of a new friction clutch pulley adapted for rolling-mills, rubber or brass-mills, saw-mills, docks, mines, warehouses, etc.; and it is said that this clutch is particularly well adapted for electric lighting service.

Its construction is comparatively simple, and its action is reliable and powerful. The hub of the guides *h h* is firmly keyed to the shaft *a;* the slotted levers *e e* work on the pivots *f f*, which are attached to the hub of the guides. One end of each of the levers *e e* engages with a journal on the friction shoes *g g*, and the opposite ends of the levers *e e* engage with the inclined arms *d d* on the hub *b*, which has freedom to move lengthways on the shaft, but it cannot turn on it. Moving the hub *b* towards the pulley causes the friction shoes to move radially outward, and finally press against the inner surface of the rim of the pulley.

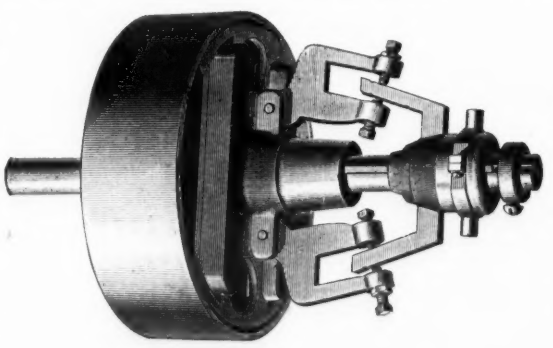
When the clutch is in action it is locked by the inside screws *s s*, whose points engage with notches cut in the ends of inclined arms, and the outside screws *o o*, whose points engage with the notches cut in the other ends of the inclined arms and lock the clutch when disengaged, so that no longitudinal pressure on the shipper is required for holding the clutch in or out of action. The screws *s* and *o* are also used for adjusting the clutch.

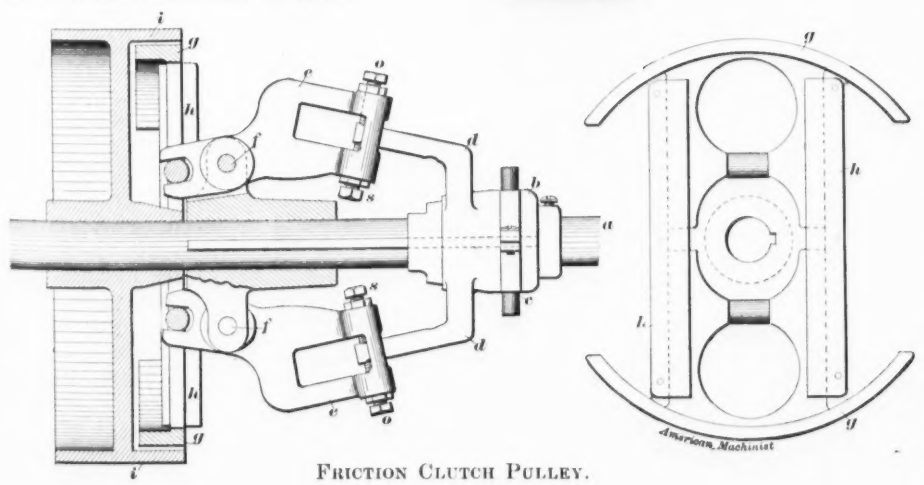
The shipper may be attached to the loose bronze ring *C* fitted in the annular groove in the hub *b*.

For high speeds the centrifugal force of the friction shoes is counterbalanced by the slotted levers.

The friction surfaces are all of iron; there is ample clearance between the friction surfaces when disengaged, and the clutch may be put in action quickly, or as gradually as desired.

These clutches are manufactured by R. F. Hargraves & Co, 101 Friendship street, Providence, R. I.





FRICTION CLUTCH PULLEY.

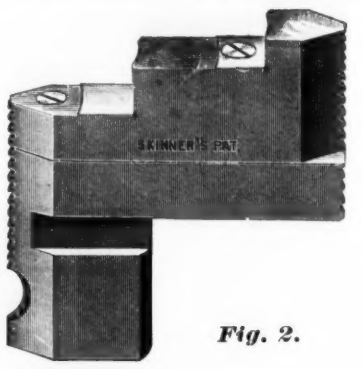


Fig. 2.

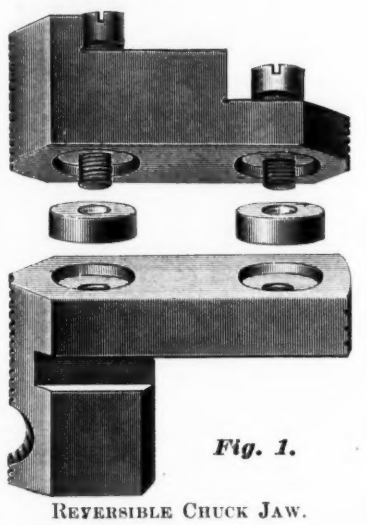


Fig. 1.

REVERSIBLE CHUCK JAW.

Reversible Chuck Jaw.

The accompanying illustrations show a new reversible jaw for lathe chucks which is so made that it does away with the necessity for running the jaw off from the screw, and as the jaws always remain in place there is less trouble in keeping them true. Both parts of the jaw are drop-forged steel, case hardened, and the working parts are ground after hardening.

An inspection of Fig. 1 will show how the two parts of the jaw are joined together, the flat washers which fit the counterbores acting as dowels, bringing the upper part of the jaw into its proper position, and holding it securely. Fig. 2 shows the upper part of the jaw reversed, and in position for holding work by gripping it outside.

The change from one position to the other is quickly made, and the jaw is practically a solid one in either position. In fact, the upper parts of the jaws are often used in practice, extended so that only one dowel and screw are in use. These jaws are now furnished, when desired, with chucks of all sizes from 6" to 42", by the Skinner Chuck Co., New Britain, Conn.

How little difference it makes in the final result what rate of interest is received, is evident from the fact that a property doubles in twenty-three years at 3 per cent., in eighteen years at 4 per cent., in fourteen years at 5 per cent., in twelve years at 6 per cent., and in only nine years at 8 per cent. If the present holdings of the Vanderbilt family be $300,000,000, they will be $1,320,000,000 in fifty years, even at 3 per cent., and over twice that at 4½ per cent.

A New Steam Separator.

Separators for live and exhaust steam are now so well known, and their importance so generally appreciated for the separation and removal of solid or fluid matter from gaseous or vaporous currents, that a short description of one of the latest developments in appliances of this kind may be of interest.

The Cochrane separator for horizontal pipes, Fig. 1, consists of a cast-iron casing, having opposite lateral openings near the top for the ingress and egress of the steam. The upper section is divided by a baffle plate, having parallel corrugations or ribs extending vertically from top to bottom, with two equal openings, one on each side next to the casing, of a combined area 25 per cent. greater than the area of the entering pipe.

Surrounding and guarding that portion of the baffle cut away on each side for the steam passage is a special deep rib to prevent water from flowing or being driven through by the current of steam. The inside of the casing is also provided with vertical ribs.

Forming the bottom of the separator proper, the sides pitch in toward the center from all directions, and lead directly to the receiving well or reservoir, the mouth of which is specially protected from the current of steam, to prevent any interference with the contents, either during passage thereto, or after coming to rest. A suitable gauge glass and valve in drip pipe completes the equipment.

The separator for vertical pipes, Fig. 2, differs from the horizontal form in having openings at the top and the bottom for the ingress and egress of steam, and in using an angular baffle plate, which plate is also provided with ribs to break up and divert the entrained water and oil from the current of

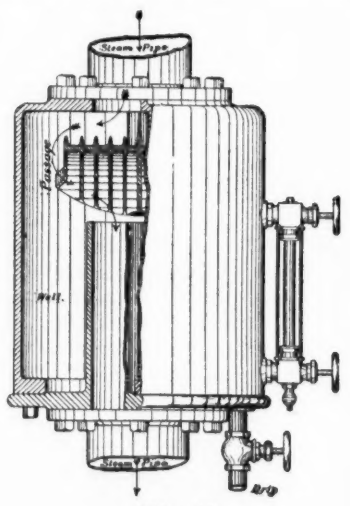


Fig. 2.

Fig. 1.

STEAM SEPARATOR.

steam, on the same general principles as those employed in the horizontal style.

The well is formed by casting on the bottom piece of the separator a pipe projection, which rises to the lower edge of the baffle plate.

The principles of action in both separators embody all the best points of approved methods for obtaining the most complete separation, and give by a straight downward course the most rapid flow to well. Release side openings for the purified current to pass out, of sufficient area to prevent back pressure, are so placed and protected that there is no possibility of any of the separated oil or water being picked up again and carried past the separator.

These separators, in sizes from 1½ upwards, are manufactured by the Harrison Safety Boiler Works, Philadelphia, Pa.

The U. S. Battle-ship "Texas."

The steel-armored battle-ship "Texas" will be launched from the Norfolk Navy Yard on the 28th inst. Her length on the water line is 301 feet 4 inches; breadth, 64 feet 1 inch; mean draught, 22½ feet; displacement, 6,300 tons. Her maximum indicated horse power is estimated at 8,600, and she is expected to have a speed of seventeen knots. She has two steel turrets placed on opposite sides of the center line of vessel, so as to secure a forward and aft fire. Her main battery consists of two 12-inch and six 6-inch breech loading rifles, and her secondary battery will include twelve 6-pounders and four 1-pounder rapid fire guns, four Hotchkiss revolving cannons and two Gatlings.

The engines, two in number, of which we give illustrations, are of the vertical, inverted cylinder, direct acting, triple-expansion type; placed in water-tight compartments, separated by the fore and aft bulkhead.

Fig. 1 shows the engine as erected in the shops of her builders, the Richmond Locomotive and Machine Works, Richmond, Va.; this view shows the engine without the crank-shaft, which was not ready before the engine had to be taken apart for shipment. Fig. 2 shows an end view of both engines in the course of construction. The high pressure cylinders are 36 inches diameter; intermediate cylinders, 51 inches; and low-pressure cylinders, 78 inches diameter; and all 39 inches stroke. All cylinders are steam jacketed. The main valves for the high and intermediate cylinders are of the piston type, one for each cylinder, and one double-ported balanced slide valve is used for each low-pressure cylinder. All are worked by a Stephenson's link motion.

The framing of the engines consists of inverted Y frames trussed by forged steel stays. The engine bed plates are of cast-steel of the I section, supported on steel keelson plates built in the vessel. The crank-shafts are made in interchangeable sections. All shafts are hollow. The shafts, piston rods, connecting rods, and working parts generally, are of forged, mild, open-hearth steel. The condensers are made entirely of composition and Muntz plates.

The barrel of all the cylinders is 1¼ inches thick. The piston valve for the high-pressure cylinder is 15 inches diameter; and for the intermediate cylinder it is 21 inches diameter. The steam lead for all cylinders is ¼-inch at top and $\frac{3}{16}$ inch at bottom; and the lap for all cylinders is 2¼ inches at top and $2\frac{3}{16}$ inches at bottom. The intermediate and low-pressure steam jackets have safety valves loaded to 80 and 25 pounds respectively. The intermediate and low-pressure receivers have safety valves also loaded to 80 and 25 pounds respectively. The piston valves are of cast-iron as hard as can be worked. The valve stems are 4 inches diameter at the stuffing box and reduced to 3 inches where they pass through the valves.

The connecting rods are 78 inches between centers, turned to 7 inches diameter at the small end, and 7½ inches at the large end. A hole 3 inches diameter is bored through each rod from end to end. The crosshead ends are forked, each side 6½ inches thick, fitted with caps and bored to 9½ inches diameter for the brasses; bolts, 3 inches diameter. The crank-pin end of each rod is 13½ inches thick and bored 18½ inches diameter for the brasses; bolts, 4 inches diameter.

Pistons are of cast-steel of the dished form, with bosses 10½ inches diameter at the center for the piston rods. Followers are of cast-iron with 9 bolts for the H. P., 14 for the I. P., and 24 for the L. P. pistons. One cast-iron packing ring is used for each piston 1½ inches thick, 6 inches wide, cut obliquely, and fitted with composition tongue. The holes for the piston rods taper from 7¼ inches to 5¾ inches diameter. The piston rods are 7¼ inches diameter with collars 8 inches diameter.

The crossheads are of cast-steel with composition guide gibs 22 inches long, 19 inches wide. The crosshead pins are cast with the crosshead and are 8 inches diameter, 9⅛ inches long.

The eccentrics are of cast-steel; the high-pressure eccentrics form one casting; those for the intermediate and low-pressure cylinders are cast in two parts; the eccentricity is 4 inches. Eccentric straps are of cast-steel, I section, and held together with two steel bolts 2 inches diameter. The length of rods from center of eccentrics to center of link pins is 78 inches. The links are of the double-bar type; bars, 1⅜ inches thick, 5 inches wide. Eccentric rod pins, 3 inches diameter, 3⅛ inches long; the journal for valve stem crosshead, 5 inches diameter, 4¾ inches long, with a hole 3½ inches diameter bored through it lengthwise; suspension links, 33 inches between centers.

The reversing gear for each engine consists of a steam cylinder and a hydraulic controlling cylinder placed vertically, and acting directly on an arm fixed on the reversing shaft. The steam cylinder is 12 inches diameter, and the controlling cylinder 6 inches diameter, with a stroke of 17½ inches. There is one reversing shaft for each engine made in two lengths with flange couplings. The shafts are made of forged steel 8 inches diameter at the largest part, tapering to 6 inches at the ends. There are five bearings, two of them 6 inches diameter, and three 8 inches diameter.

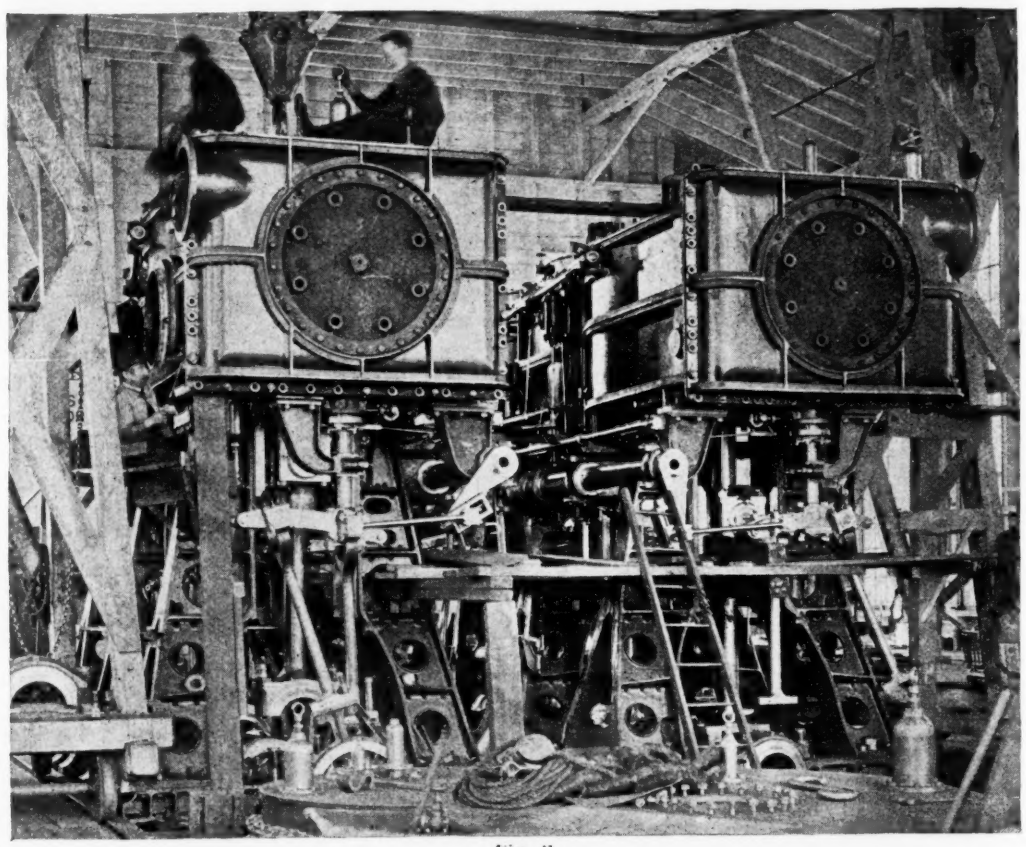


Fig. 2.

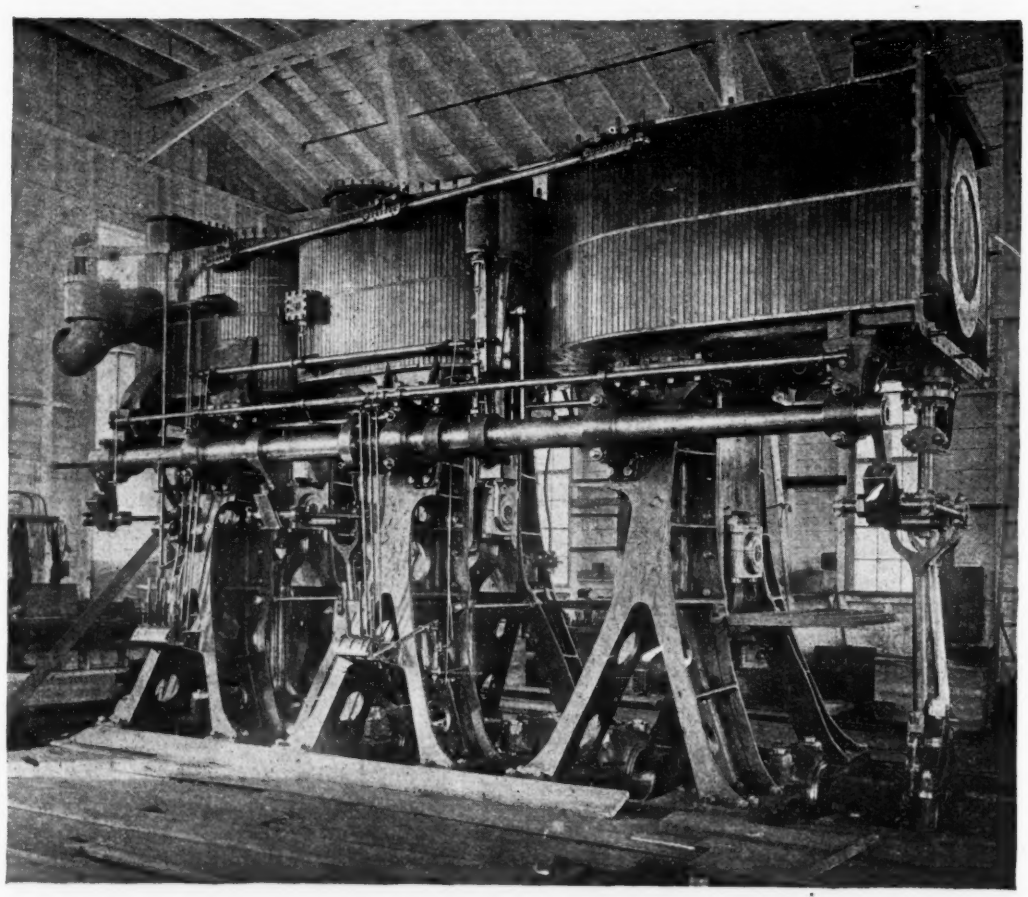


FIG. 1.—ENGINES OF U. S. BATTLE-SHIP "TEXAS."

A 16 inch exhaust pipe leads from the exhaust side of each H. P. valve chest, with a 16-inch branch to each end of the corresponding I. P. valve chest; a 21-inch pipe fitted with a slip joint leads from the exhaust of each I. P. valve chest to the corresponding L. P. valve chest; and a 26-inch pipe leads from each L. P. valve chest to the corresponding condenser.

The crank-shafts are in three sections all alike and interchangeable. Each section has a crank 19½ inches throw, also a coupling disk, 3 inches thick and 24 inches diameter, forged to each end. The crank-pins are 14½ inches diameter, 18 inches long. The crank webs are 15½ inches wide, 8½ inches thick. Each section of shaft is 6 feet 8 inches long. The journals, one on each side of the crank, are 14 inches diameter, 19½ inches long. A 6-inch hole is bored axially through each shaft, and a 7-inch hole through the crank pins. The cranks are set at angles of 120 degrees to each other, the L. P. crank following the H. P., and the I. P. following the L. P. crank.

The thrust shafts are 13½ inches diameter, 19 feet 7½ inches over all, with 6-inch axial holes. There are eight thrust collars, 2 inches thick, 23 inches diameter, with a 3½ inch space between the collars. The line shafts are 13½ inches diameter, 19 feet 8 inches long, with 6-inch axial holes.

The propeller shafts are made in two lengths. The forward length is 14⅜ inches diameter, 25 feet 3 inches long; the after length is 14 inches diameter, 30 feet 4¼ inches long. The forward section has a 6-inch axial hole, and the after section has the same size of hole extending from the forward end to where the shaft is tapered for the propeller hub, where it is reduced to 3 inches.

The starboard propeller is right, and the port propeller left-handed, four-bladed, 14 feet 6 inches diameter; pitch cast to 17 feet 4 inches, adjustable from 16 feet 6 inches to 18 feet 3 inches. The helicoidal area is 66 square feet.

The condensers are 5 feet 9 inches internal diameter, made in three sections. Each condenser contains 3,160 seamless drawn tubes ⅝ inch external diameter, No. 19 B. W. G., 12 feet 6 inches between tube sheets spaced $1\frac{1}{16}$ inch between centers. The total cooling surface is 6,312 square feet.

The air pumps are 15½ inches diameter, 15 inches stroke, driven by compound engines with cylinders 10 and 18 inches diameter, 15 inches stroke.

Steam is furnished by four double-ended boilers of the horizontal return fire tube type, constructed for a working pressure 150 pounds per square inch. Each boiler has six corrugated furnace flues, 3 feet 3 inches

internal diameter; 168 stay tubes, and 642 ordinary tubes 6 feet 9 inches between tube sheets, spaced 3½ inches between centers. Total heating surface, 16,913 square feet; grate surface, 532 square feet.

The limit of the cost of the "Texas," as fixed in the act of August 3, 1886, authorizing her construction, is $2,500,000, exclusive of her battery. When Congress authorized the construction of this vessel, no steel war vessels of this character had ever been built in this country, and, therefore, Secretary Whitney selected a design from English competitors, who, with others, were invited to submit plans. This vessel has therefore been built from English designs. Although the "Texas" will be a valuable addition to the navy, it is not probable that another vessel will be built like her. Rapid advance in naval construction has been made in late years, in which our engineers have contributed their share, and they have found that with a very little more expense a great gain can be achieved in various ways.

Twenty-fifth Annual Convention of the American Railway Master Mechanics Association.

Beginning June 20, and continuing three days, the Master Mechanics held, at Saratoga, N. Y., their twenty-fifth annual convention, which is very generally conceded to have been the most successful one so far held by the association. With the usual promptness attending the meetings of this association, the call to order on the first day was but little later than 9 o'clock, A. M., the hour set for the meeting. There were present, as shown by the roll call, about 150 members; there were also present a good many friends of the members. As usual in late years, the convention followed immediately after that of the Master Car Builders, which doubtless helped to swell the attendance.

The customary formalities, such as an address of welcome by the president of the village, were gone through with, followed by President Mackensie's annual address.

The president referred to the satisfactory condition of the association after an existence of 25 years. Especially during the past five years the growth had been phenomenal. When they met at St. Paul, in 1887, the membership was 270. Since that time 241 names had been added, making the membership at this time 511. They were now an organization composed of representatives of the mechanical departments of nearly every railroad on the continent of North America. "We are recognized," he said, "because, by our perseverance, we have shown to our superior officers that such recognition is our due, from the fact that we have shown a determination to promote their interests by a faithful desire to improve upon and care for the property confided to us in trust. Let us feel greatly encouraged in our own enterprise, and enter upon the work before us with renewed zeal, and a permanent and gratifying success will crown our efforts." He hoped members would continue with their advice and their work, until the working of the mechanical department of railroads come to as near perfection as possible.

THE SECRETARY'S REPORT.

Secretary Sinclair then presented his report. In it he said that there had been an increase in membership of 53 during the past year, which is greater than the average for five years as given by the president. There were a large number of men eligible to membership, from which members could be drawn. There was no reason why the increase in membership should not go right along. Application had been made to the Secretary of State, and, as a result of such application, the association had been incorporated under the laws of the State of New York; the association was now an organization having legal standing.

The association has four memberships in Stevens Institute at its disposal. Referring to this, the secretary said that only one applicant passed examination, owing to its rather severe nature, and the short time for preparation. Arrangements had, however, been made by which scholars could be admitted to the preparatory school of that institution sufficient in number to keep the scholarship full.

EXHAUST PIPES, NOZZLES AND STEAM PASSAGES.

The committee on the above subject felt obliged to say that no report was ready. There had been much in the way of getting information, and but little in the line of increased knowledge on these subjects could be hoped for until some arrangements for more definite tests could be made.

This committee is, we believe, an old one, and, as it is dealing with important questions, doubtless the association will give it opportunities for making tests of value.

CAR COUPLERS.

It is not for the reason that the country is not full of automatic car couplers that the committee had so little of value to report. The very multiplicity of these devices may have something to do with the matter. The Master Car Builders are wrestling with the subject, and the Master Mechanics are perhaps more prone to adopt their conclusions than to arrive at conclusions of their own.

STANDARD TESTS OF LOCOMOTIVES.

It was brought out by this committee that nothing particular had been done, owing to the fact that the American Society of Mechanical Engineers was working on the same question, and it was thought that there should be a conference.

COMPOUND LOCOMOTIVES.

The report of this committee, and the discussion it brought out, was the great feature of the convention. The report of the committee was to the effect that it was as yet impracticable to present a theoretical discussion of the subject; the consideration of the subject had gone from the realm of theory to that of practice. To-day the engine was in such an early stage of development that designers were not fully prepared to give the required guarantees.

The report continued:

Your committee wish to offer a word of caution here regarding locomotive tests in general. Those who expect to find that any set of tests, however complete, will give a complete history of the machine under all of the complicated conditions found in service, will be greatly disappointed. No scheme which would furnish such results has been advanced by authorities. The number of undeterminable variables entering into a road test is enormous, and the conclusion to be drawn from the determinable ones even is a most perplexing problem. Both these classes of variables are mutually dependent, and a change in any one introduced a change in the economic results of the engine performance. Probably a combination of two methods of test would furnish a conclusive basis for comparison, but, unfortunately, both these methods involve practical difficulties, making them almost prohibitory. The combination referred to is a shop test of the engine, where an absolutely uniform set of conditions could be maintained and its economy as a producer of a varying amount of work determined. These conditions of work could be made to imitate those obtained on road with all practicable train weights. To obtain the comparative economy of the locomotives as a *whole*, including the boiler and engine functions, a standard set of road tests is essential. This would involve hauling successively the same special train with each engine over the same road, at the same speed, with same crew, and with all extraneous conditions alike; and afterwards repeating such tests for the entire range of train weights. It is needless to say that your committee have not been able to entertain such a programme In absence of this scheme the best plan seemed to be an imitation of the *average service conditions* prevailing over a considerable period of time. It was assumed that if the test could be prolonged for a period of say one month with each engine, taking the trains as they were offered by traffic conditions, there would result an average figure for economy, which would be repeated month by month, and consequently give an idea of the economy appearing on the performance sheets.

The report of the committee was very voluminous, representing a good deal of labor, but, as the committee intimated in the beginning, was not conclusive.

In discussing this question, Mr. Vauclain, of the Baldwin Locomotive Works, referred to tests made by the works showing a saving by compounding of 17 per cent. to 45 per cent., which would go to show that other conditions than that of higher steam pressure on the compounds influenced the results.

Mr. Pitkin, of the Schenectady Locomotive Works, said they had gone into compounding as a matter of experiment. "If asked whether we could recommend the compound, we have said no; here is the simple, and here the compound; take just which you please."

Mr. Lythgoe, of the Rhode Island Locomotive Works, said they were not advocating compounds very strongly. They had built a number, and they were showing a saving of from 15 per cent. to 30 per cent.

Others had found saving from 5 per cent. to 25 per cent.

Mr. Lauder was conservative. He did not believe savings of 25 to 30 per cent. were obtainable. If, as Mr. Casanave had stated, the saving was only 5 per cent., he did not believe it would pay any railroad to use compound locomotives, because they must cost something more, and the cost for repairs would be greater. Mr. Lauder had made experiments with compounds, and spoke favorably of them in some respects, but he was evidently unprepared for believing strongly in their greatly superior qualities. He thought a good deal of experimenting was necessary.

This evident disbelief in existing types or a type, brought out Mr. Vauclain again, who disagreed with the statement that the compound would cost more in the way of repairs. He admitted that, in some respects, the repairs would be greater, but made an offset by the greater life of the fire box of a compound. He said: "The life of the steel depends upon the number of gallons of water evaporated." One of his previous remarks was: "I cannot see why there should be any difference in the water per horse-power given out in either type." He disclaimed the idea that a compound engine should be constructed with special relation to peculiar work.

His argument, in effect, was that railroads must put compound locomotives to the test before the possibility of formulating conclusions. This was in opposition to the remarks of another member, that railroads must be satisfied of the merits of compounding before purchasing compound engines, was good.

Mr. Lauder replied to Mr. Vauclain's strictures, in part, as follows:

I do not agree with Mr. Vauclain on the question of repairs. I believe his position entirely wrong. I do agree with his statement that the life of the fire box depends on the amount of evaporation of water, but he neglects to mention one of the important features which has quite a bearing on the life of the fire box; that is, the higher pressure we can carry on the compound. I think every railroad man will agree with me that the higher the pressure carried the sooner the fire box will wear out. If you can secure 15 per cent. saving I believe you are warranted in using the compound. It is not necessary to build and maintain four-cylinder compounds when you can get equally as good results out of the two-cylinder type.

COMPOUND LOCOMOTIVES AGAIN.

On the assembling of the convention on Tuesday it was soon made apparent that those who had entertained the belief that the major part of one day would suffice for the purpose of discussing compounds had wrong views; for the discussion was even more interesting on Tuesday. The discussion was opened by Mr. Mitchell, who practically ignored the question of fuel economy, and brought out the question of the superiority of the compound, in that it threw less fire, and thus endangered property less. This consideration, he thought, was going to be one of the main points in the compound, in addition to the saving of fuel.

Mr. McBeth had experienced no abnormal oscillations in riding on a two-cylinder compound down grade at 30 or 40 miles per hour, with an especially arranged drawbar between engine and tender. He had just finished making a test on the Central Vermont, the compound showing a saving of 30 per cent. to 35 per cent., and the evaporation was 8¼ against 5¼.

The noticeable point in this is that the saving in evaporation was, as far as can be seen, exactly equal to the total saving.

Mr. Dean had made tests in which, after increasing the clearance on the compound, he had obliterated undue side oscillation; he found an advantage in some instances of 19 per cent., and in others 30 per cent. in favor of the compound. He found a saving in water in favor of the compound sometimes about equal to the saving in coal.

Mr. Forsyth referred to the discrepancies in the records of the committee, whose work, he said, was superior to anything of the kind previously done. Still the records showed that the variations were very great in cases where there should have been little or no variation. The committee admitted that the discrepancies pointed to the fact that the tests could not be depended upon. For example, the coal per ton mile with the same engine varied from .075 to .1500—in one instance nearly double that in the other—and in one case the coal per horse-power was 5 pounds against 3⅛ pounds in another, showing that the attempt to get an accurate test of locomotives with a train in regular service is not very satisfactory, and the figures give an economy of 6.1 per cent. one way and 9 per cent. another; then there is a further conclusion that the economy was 16.9 per cent. and 14.1 per cent. We should expect from a compound engine of this type [the Vauclain] on passenger service a saving of not more than 7 to 8 per cent. The committee's tests showed an economy of 30 per cent.

Mr. Leeds gave some figures that were not calculated to show more than a nominal saving for the compound.

Mr. Setchell, Pittsburgh Locomotive Works, remarked that they were constructing a compound, and that by giving an increased heating surface, a much larger boiler and all the other advantages they could over the plain engine, expected to show a saving equal to any of our competitors.

Mr. Smart spoke in a way to show that in his opinion a compound must be designed rather especially for the work to be done, and that where the work was heavy one way and light the other, the gain in one would be neutralized by the loss in the other direction. He had never claimed (on the Michigan Central) a saving of more than 12 to 15 per cent. for the compound under the most favorable conditions.

Mr. Soule had found a saving of 20 per cent. in fuel, some changes in boilers having been made in favor of the compound.

Mr. Barr, as the result of research, failed to find evidence that there was a saving of 10 per cent. in favor of compounding.

Mr. Forney, who had quite generally been accredited with favoring compounding, declared himself as being an agnostic. Amongst other things he said:

I feel that the advantages and superiority of the compound have not yet been fully proved. In taking up this subject, we should see clearly what the real question is. I conceive it to be this: Supposing a railroad company wishes to have locomotives weighing 100,000 pounds for a certain traffic. Supposing the general manager should go to the advocate of the compound engine and say, "We want you to build an engine weighing 100,000 pounds for such and such a traffic." Supposing the general manager should then go to some other builder and say, "Build us some simple engine of 100,000 pounds weight," naming to this builder the same traffic. He should tell them both that what they have to do is to put 100,000 pounds of steel and iron into their respective forms of locomotive that will give the best service for the work to be done—that they are to avail themselves of whatever advantages they may have. In this suppositious case he would then have the highest degree of efficiency of the two systems. A test then made would develop something. It is generally acknowledged that compounding increases the weight of the locomotive considerably—to that extent it is a disadvantage. The simple engine man might take that extra weight and put it into a boiler, getting a larger boiler on the simple engine. If the simple engine has an advantage in weighing less, you have a right to avail yourself of that. In all the discussion in nearly every instance the compound engine advocates have asked for odds in their favor. They ask to make the engine heavier. It seems to me the conditions should be exactly the same under all the circumstances. At this meet-

(*Continued on page 9.*)

The Buffalo Meeting of Boiler Manufacturers.

Just one year and one month from the date named below the boiler manufacturers adjourned at St. Louis to meet in Buffalo this month, on the 14th.

The opening session should have been at 10 o'clock, but the question of lateness came in, just as it always comes in with many societies when getting together on time is concerned. Ten o'clock went along up to 11 before the hammer of President Lappan called the fifth meeting of the association to order.

Representatives of the A. B. M. A. were present, as a matter of course, and there were also present those interested in what was to be done at the meeting.

UNITED STATES REPRESENTATIVES.

Colonel Dumont provided for a representation of inspectors, to the end that these men might give and take information. It followed, as a matter of course, that there was something to be learned at Buffalo, and that there was some information to be imparted by the government representatives, and right here it may be said that the men who inspect boilers for the United States a e the most willing of all men in the world to impart information that comes up to them; to impart it for the general good. There were representatives from New Orleans to New York, and they helped the meeting along with their experience.

The A. B. M. A. was right in its expressions of thanks to them.

PRESIDENT'S ADDRESS.

Following all precedent, President Lappan opened the first meeting by an address to the members. He showed what had been done, and the necessity for doing more. Boilers were being sold that were only apologies in their way, and the man who did honest work was left in the rear. Not only boiler manufacturers, but boiler users, must be educated to know the difference between good and poor material and good and poor workmanship. Boiler manufacturers were made tired by the competition of those who would sell anything that would hold together for a few months. There were certain requirements in the manufacture of boilers, and the man who was honest enough to meet those requirements was the one who got left.

The president's remarks were listened to with marked attention, and the strong points he made, which were many, brought out applause.

INSPECTION, INSURANCE AND LICENSE.

This never-failing question came up, and it must be said that it was handled with rare good judgment. The honest boiler manufacturer does not believe he knows all there is to be known about boilers, and he wants the efforts of others to help him out—men who are trained to inspect boilers with a view to making money by insuring them are fully appreciated by boiler manufacturers, and competent men in charge of boilers are needed. Stationary engineers who believe in license laws will make no mistake in consulting boiler manufacturers, to the end of bringing about the enactment of the necessary laws relating to inspection. The engineer can beat any boiler made, and he will beat it if he does not know his business.

HORSE POWER.

When the question of the horse-power of a boiler came up the boiler manufacturers were all at sea—not to say that they did not know anything of the subject, but that there was too much difference of opinion.

When Watt first put in engines to take the place of horses he established what seemed best to him in the way of relation between the efforts of horses and steam, and there has been trouble in the matter ever since. Horse-power is a term particularly applicable to engines, but even there its economic consideration leads to confusion. One engine requires but twelve pounds of water evaporated per horse-power and another requires sixty.

Probably the best attempt to settle the question of horse-power as applied to a boiler was that made at the centennial exhibition at Philadelphia. This, with the necessary modification, has been recommended by the American Society of Mechanical Engineers, and is the evaporation of (about) 34½ pounds of water from and at 212 degrees. This was brought up before the boiler manufacturers, but was met by the argument that there was too much of theory about it. As a matter of fact it is a question of very simple figures, but the name and the surroundings are against it, apparently.

The boiler manufacturers sat down on theory, so-called, as if it were something beside the getting together of practice in a form to be conveniently used.

EXECUTIVE SESSION.

President Lappan, in the most pleasant way in the world, on Thursday, informed the representative of the AMERICAN MACHINIST that it was advisable that he retire for a short time—it came out to be an hour and a half. All this had to do with the blazing question of strikes. We shall not expose any secrets, but will say, on pretty good authority, that the boiler manufacturers left this question just where they found it. When workmen took it upon themselves to strike for more money or less hours there wasn't any law to prevent such action on their part; if they were foolish in striking, the results of ill-advised action had to be divided up between workmen and manufacturers. It was brought out that manufacturers did not feel willing to accord a nine-hour day, but, on the contrary, the plan of work by the hour rather broke up this reasoning. Men, it was reasoned, had a right to work as few or as many hours out of the twenty-four as they choose, and should be paid for what they worked.

The secrecy surrounding the proceedings of the association on strikes was unwise, in our opinion. Probably there isn't an intelligent boiler maker that cannot find out about what was done at the executive session, and with the masses the environment of secrecy will breed bad feeling. Still it will not amount to anything in partcular; it simply looked like throwing away time, and leaving the matter where it was in the beginning. Boiler makers, we believe, are not, as a class, especially given to strikes, and boiler manufacturers do not object to paying as good wages as they can, and compete.

THE LETTER BALLOT.

Patterning after the usual practice, the boiler manufacturers have adopted the letter ballot in the election of officers. Previously, the popular plan of putting a man in nomination and electing him by the voice of the members present has prevailed. Hereafter the letter ballot will be in force. This is more dignified, and probably better than previous practice.

THE NEXT MEETING.

The committee named to locate the next meeting place of the association has fixed upon Chicago, and named the time as the 13th of June, 1893—Fair year. This means a big meeting.

FUTURE PROSPECTS.

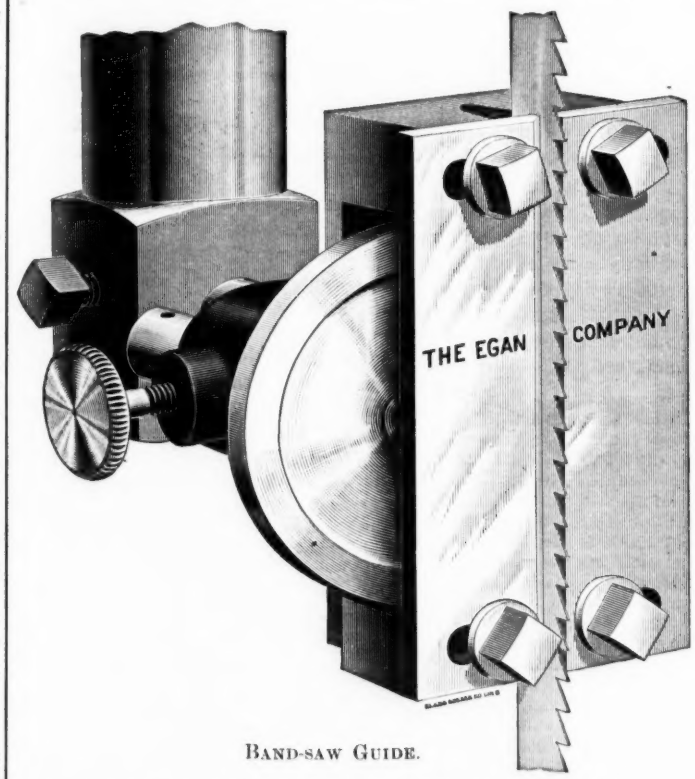
With everything so pleasant, it seems rather too bad to make any remarks about the future of the A. B. M. A., still the truth cannot do harm. And speaking the truth, unless individual members take more interest in the association it will die a natural death. The association was started with good objects in view, but a half dozen men, working never so well, cannot run it to success. Others must come up to help, and unless they do so it is certain that the utility of the association is not believed in. But this view of the case is not probable; it is only set forth as a possibility, not as a probability.

EXCURSIONS.

Buffalo was very generally visited by the boiler manufacturers, and a trip to Niagara was made to conclude the pleasure jaunts. After that the members dispersed.

FUTURE OFFICERS.

Phil Rohan was elected president of the association without a dissenting vote. And Mr. Garstang came in as vice-president in the same way. Col. Meier was elected secretary once more, because there was nothing else to do; Richard Hammond, of Buffalo, was put in the position of managing the finances of the association for the year of 1893.



BAND-SAW GUIDE.

COL. O'BRIEN,

who was present from New Orleans, was very intimately connected with fitting out the "Alabama," which gave the government a good deal of trouble. When he could be persuaded into giving some reminiscences relating to that rather notable vessel, there was sport for the boiler manufacturers. They took in the whole matter just as if it was not rather against them. His statement of the final disbandment of the crew was fit to find a place in the general literature of the war, which will be read without any hard feeling.

Col. Meier, as secretary, came to the front, as could have been expected. The secretary of such an association as that of boiler manufacturers is really the "best man," and he is depended upon to steer the proceedings. The president falls back on him, and gets lifted out of many a bad place.

THE GREAT OBJECTOR.

Mr. Garstang, of St. Louis, was—he has always been—the great objector in the association. Whatever comes he objects to, on general principles. Not that he does this outside of reason; to the contrary, he always seems to be able to fortify what he has to say with something pertinent. All through the sessions Mr. Garstang came up with practical suggestions; broke theory all to pieces, so to speak.

Just as we have intimated, unless there is more interest brought out by the A. B. M. A. it will go to pieces; that is, it will cease to exist. It would be unfortunate if this came about. There is plenty of space for it to exist in, and plenty of work for it to do.

Mr. Burke, the official stenographer of the association, though a very young man, did his work—sometimes not very easy work—in a manner that was universally commended by the members who were present, and which will tell in the published proceedings.

Band-saw Guide.

We present herewith an illustration of a band-saw guide, which has been designed to overcome some of the difficulties encountered with the ordinary guide, in which the back of the saw bears against a roller in a single narrow line in such a way that a deep groove is soon formed, which is objectionable, one of its chief disadvantages being the fact that it causes the saw to be deflected slightly over the roller with a very short bend, which in time has an injurious effect upon the life of the saw.

In the present guide the roller is turned about at right angles to its usual position, so that the blade rests upon the flat front face near each edge, and has a considerable bearing surface, which surface is brought down as close to the work as possible. The disk is of hardened steel, as are also the side guides, all being adjustable to suit any desired thickness or width of saw, and so that saws are held as close to the teeth as possible. Bearings of the spindle on which the roller turns are also of hardened steel, and so arranged as to be easily kept lubricated.

It has been found that with this guide it is entirely practicable to wear blades down from 1″ to not much more than ⅛″ under circumstances where this was impossible with the old style guides.

This guide is made to fit any machine by The Egan Company, Cincinnati, O.

LETTERS FROM PRACTICAL MEN.

Pitting in Boilers.

Editor American Machinist:

Corrosive pitting of boiler plate is very liable to occur underneath scale.

There appears some reason to suppose that the oxide of iron then produced is the magnetic or black oxide, the chemical formula of which is Fe_3O_4, and which is formed when iron is oxidized in air, oxygen, or aqueous vapor, but it has sometimes occurred to me that the black filling of the pits may be a compound of iron with some ingredient of the scale.

In my own experience the worst cases of pitting under scale have been with a sulphate of lime scale, and I have seen a boiler on which the whole under water surface was a brilliant white, and yet beneath the scale the plates were all more or less corroded and pitted.

When corrosion occurs beneath scale I should not like to say positively it could be stopped, but I do not believe at present that in a boiler free from scale there is any corrosion going on in pits or otherwise when the water is ever so slightly alkaline I do not mean it is to be alkaline as tested on going into a boiler, but that a sample drawn from the boiler at work shall show alkaline reaction; for in numerous cases vegetable matters may perhaps produce acids in the boiler itself, but, what is more to the point, the feed water may be ever so slightly tainted with acid. The water evaporates, but the acid remains and concentrates, and I have known a boiler in which such concentration occurred to show very plainly that it had contained what was best called dilute sulphuric acid. The boiler exploded and killed two men who need not have been killed if an occasional test had been made with litmus paper. But I have grown to have no sympathy with any far-fetched theory of pitting any more than with fancy theories of boiler explosion. Few people realize how great is the amount of water which passes through a steam boiler, nor do they realize the concentration of acid from its non-volatile nature. In this respect, clean non-scaling water may be a source of unsuspected danger, for if not necessary to blow out any accumulation of mud there will be a greater chance of acid accumulating; nor must such an alkali as soda be allowed to accumulate in a boiler, for soda loses its solubility at high temperatures, and must not be left to accumulate indefinitely.

In regard to the pitting under scale, and the formation of the black oxide, is it not reasonable to suppose that the scale keeps the plates hot, but allows them to be exposed to aqueous vapor generated in the scale next the plate, and that the action of the hot plate upon this is the cause of the oxidation, hydrogen being set free just in the way that hydrogen is made in the laboratory, by passing steam through a hot tube filled with iron filings which absorb the oxygen, and so decompose the steam with evolution of hydrogen? If this be the cause of pitting, the remedy is clearly to prevent the scale. Where water actually acid in character is used for a boiler, it is not, as a rule, a scaling water. It may be costly to neutralize the acidity with soda. In such cases it is probable that filtration through limestone chips would kill the acid and even promote the deposition of the thin eggshell scale so much desired if it can be kept down to that thickness. Should scale form too freely, the exposure to the limestone should be reduced. A stoppage, with a return to the untreated water, would very soon loosen off the scale, but it is a risky thing to advise, as I have known advised, the removal of such with dilute acid; for the process demands perhaps more care than can ordinarily be afforded. Ordinarily, however, I do not think that incrustation in a boiler is likely to endure very long after the use of the water which produces it is discontinued, for there is a great tendency to blister off, and this makes matters worse, for fresh scale is produced, which re-cements the loosened flakes.

If there is any one cares to try the experiment with dilute acid upon an old scaly boiler out of work, let him first thickly paint any spots of bare plate, to protect them from the acid. Any loosening action which acid might thus produce upon the scale would be due to a change in bulk by reason of the formation of a fresh salt of lime. Naturally we should not in this way treat a pure sulphate scale with sulphuric acid, but with hydrochloric, and, as a matter of extra precaution, never a working boiler, unless under personal care of some one with necessary chemical knowledge. Acid sufficient to dissolve ten pounds of iron could not, for example, do very serious harm in a badly scaled boiler weighing 10,000 pounds if care were taken to prevent its action on bare plate, etc., and were accompanied by a weekly examination, and followed by a thorough neutralization with alkali.

An event of almost historical interest happened to-day, May 20. It was the departure of the last through broad gauge train from London to Penzance. About 500 people gathered at the Paddington terminus this morning to see it off at 10.15 to Penzance. To-morrow commences the narrowing process to standard gauge. I am informed that one of the old 7-foot gauge locomotives is to be sent to Chicago for exhibition. They have 8-foot wheels and are 8-wheel engines, and, had the broad gauge been continued, offered facilities for introducing large cylinders, which have not been availed of. It would appear, however, that the failure of this gauge has been due as much to the fact that it was in the minority as to anything else.

W. H. BOOTH.

Cutting Bevel Gears with Spur Gear Cutters.

Editor American Machinist:

I *did* write, in a previous communication on this subject, "S t gear cutter slide to angle of bottom of tooth"; I remember distinctly having so written, and was so printed by you. I intended to write something very different. The gear cutter slide should be set to the angle of the *pitch line*, not to the angle of the bottom of the tooth. I had both thoughts in my mind, and wrote the common practice, instead of that which alone can cut a fairly good running bevel gear with a spur cutter. I have delayed this reply, hoping to find time and place to make a careful experiment with such accuracy of work in the way of mounting a pair of bevel gears cut with spur gear cutters as should give me some certain information as to the contact and running of gears cut in this makeshift manner. Although I made a great many such gears, none of them were put on shafts which I *know* were correctly located; and accuracy of shaft location is just as important as accurate gear cutting, so far as the smooth and good working of gearing is concerned, hence I am not in a position at present to say anything certainly in the matter. I can only say that I made such gears on one job steadily as long as the job lasted —about a thousand pairs in all—and that I have continued the practice occasionally ever since, and that in all cases where the shafts were fairly placed the gearing ran well, extremely well, I might say. The gears do not look like a good job; in fact, they are very offensive to the eye if the face of the gear is long in proportion to the pitch diameter, because the cut made on the wrong angle, but the gears run still, and wear well.

I have referred to the location of bevel gear shafts, which is very often incorrect; in fact, it is an extremely nice job to bore two holes at an angle so that the holes shall cross each other at a given point lying in the axis of both. Commonly the axes of the holes do not intersect, but pass a little to one side of each other, and hence call for a skew bevel gear instead of a plain bevel gear; under such circumstances the best work ever made by Hugo Bilgram will fail to run as bevel gears can run.

One point of "brag" which "Star-spangled American" correspondents of the AMERICAN MACHINIST have overlooked, and a good one, too, is to be found in bevel gear cutting machines. In a recent conversation with Mr. Muir, of Manchester, Eng., he informed me that he had Bilgram's machine for small work, and the Rochester machine—Gleason's, I think—for large bevel gears; and it is a little odd, considering the high rank of English millwrights, that all the good bevel gear cutting is distinctly and undoubtedly of American origin. I do not know who was first, but Corliss, Gleason and Bilgram—I think I mention the names in order of time—have each produced admirable engines, which are capable of doing work better than was before possible. But despite the fact that these three illustrious examples of American bevel gear cutters exist, many large shops continue to cut bevel gears in the old manner, with several different passages of the cutter over each tooth, and, in many cases, subsequent filing, after the gears are in place, to obtain a quiet action. In some of our largest machine tool making shops I have noticed that it is quite the rule to "doctor" every pair of bevel gears a little with a file after they are in position; this practice, which may be described as distinctly on the "botch" order from one point of view, and with equal propriety may be regarded from another standpoint as absolutely good work, being made needful by want of accuracy in boring shaft seats, and by eccentricity due to keying. It is difficult to bore the holes for the shafts where the holes should be bored, and it is impossible to key a gear on a shaft with an ordinary key without making the gear run out of true. But for all this it would seem to be a good idea to use Bilgram's bevel gear cutters, if he would sell them to be used, and to use the file as little as possible, because the one, or two, or three hours spent by a good fitter in taking the noise out of a pair of howling gears is an item of expense worth considering.

To return to the original subject of the single pair of bevel gears—the "hurry job" which *must* be made with what is at hand, right or wrong, I shall try to soon place in the hands of the editors of the AMERICAN MACHINIST a pair of mounted bevel gears cut with a spur gear cutter, which will show that the method is useful. EASY WAY.

[We may say regarding this that Mr. Walter Gribben has already shown us bevel gears of small pitch cut in this way, that were apparently very satisfactory as bevel gears usually go, and certainly much better than many such gears that are cut with special cutters.—ED]

Bill Smith and His Monkey Can.

Editor American Machinist:

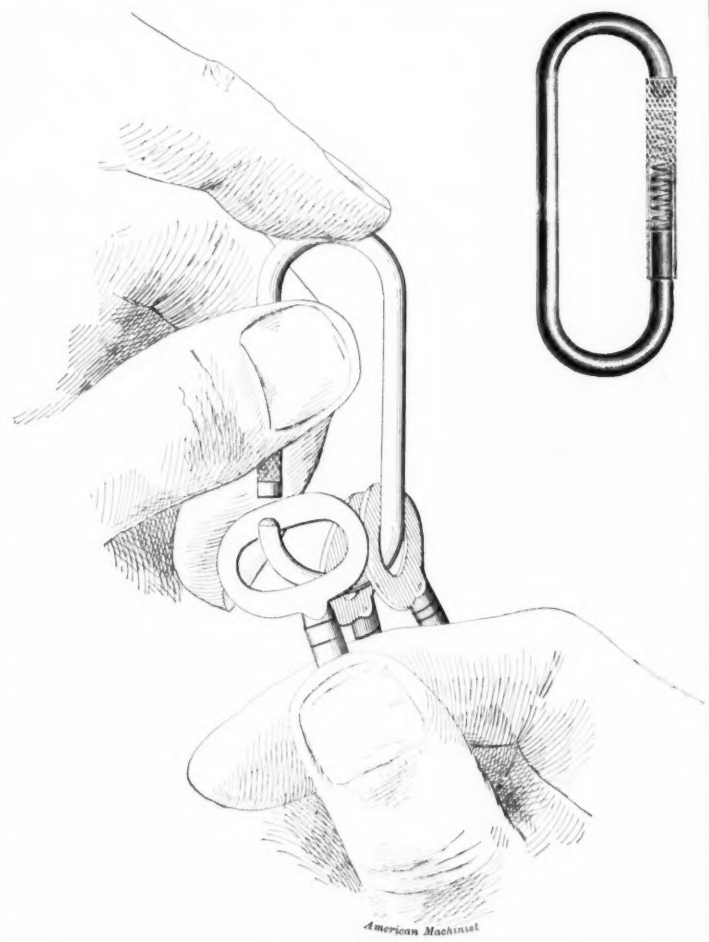
You remember Bill Smith? You know he was always trying to "get up a patent," but you didn't know that he really got up something worth patenting after all, did you? Let me tell you about it: Bill made a big improvement in monkey cans, and all the boys in the shop tried it, and said it was the best thing out; so Bill began to plan a brown-stone house with a cupola on top, and when the largest manufacturer of monkey cans and oil wrenches in America wrote to Bill, and wanted to know how much he would take for his patent, Bill shoved the house up another story, and put a revolving dome with a telescope inside, in place of the plain cupola; of course you understand that the house thus far existed only in Bill's imagination, whereas, at the present, the house—but never mind the house now.

Bill told the monkey can manufacturer that he proposed to get all the benefit from the patent himself; that he had carefully estimated the whole business, and could easily make a profit of 62½ cents on every monkey can, and then the manufacturer told Bill that, if he would give him the exclusive right to manufacture them, he would start in at once, and pay Bill a royalty of 87½ cents each, which was 25 cents more each than Bill could make according to his own figures, and after considering the matter over night, and adding a cast-iron dog, and a cast-iron woman holding an eel or something of the sort, with water squirting from its mouth, to the ornaments on the lawn in front of his house, Bill wrote to the manufacturer and accepted his proposition, and in due time the contracts were signed.

At the end of six months Bill bought a plug hat, and a railroad ticket to the manufacturer's town, and started to visit the manufacturer and collect his royalties. When he arrived, he was handed a check for 88 cents, with the explanation that they had only as yet made one monkey can.

Then Bill realized that his patent was shelved for 88 cents. JAR-YES.

P. S. The house is not built yet.



BILLINGS' KEY RING.

Pattern Makers' Bench.

Editor American Machinist:

Will some of your numerous readers give the most convenient pattern makers' bench? I wish to build one, and am satisfied that there is something more convenient and compact than we have here, and, like the machinists' tool chest, all that is wanted is to bring the different ideas out.

F. H. FELSOM.

Billings' Key Ring.

The key ring, of which we give a full size illustration, consists simply of an oval ring cut at one side, and a sliding knurled sleeve; the latter is backed up by a finely tempered spiral spring, which causes the sleeve to close the opening in the ring. The whole is made of steel, nickel-plated, and is of a very handy form.

The superiority claimed for this ring over others now in use lies in its shape, and the facility with which the keys can be put on and removed from the ring. The manner of operating is clearly shown in the illustration. These rings are manufactured by the Billings & Spencer Co., Hartford, Conn.

To say the least, it is not a very cheerful prospect which confronts the workmen in one of the Carnegie establishments in Pittsburgh, the proprietors demanding a scale of prices for the coming year which will be a very serious reduction in wages, and showing their determination to enforce their ideas by inclosing the works in a high tight board fence, guarded at the top by barbed wires which can be charged with electricity, inside of which barricade they are erecting barracks and eating houses for men who it is evidently expected may find it desirable to remain in the works day and night for some time. A covered way extends from the inclosure to the railway.

The men only ask that wages shall be maintained at their present rate, but there is such a material difference between the two proposed scales that there can be no settlement without substantial concessions from one side or the other or from both. We hope that all parties to the contest will let their reason control their actions, and that each will look at the matter from the standpoint of the other.

A bishop was traveling in a mining county and encountered an old Irishman turning a windlass which hauled up ore out of a shaft. It was his work to do this all day long. His hat was off and the sun poured down on his unprotected head.

"Don't you know the sun will injure your brain if you expose it in that manner?" said the good man.

The Irishman wiped the sweat off his forehead and looked at the clergyman. "Do ye think I'd be doing this all day if I had any brains?" he said, and then gave the handle another turn.—*Milwaukee Sentinel.*

A large manufacturer took into his office a nephew who was rather feeble-minded. One day the nephew came to his uncle and complained of the head clerk, Jones.

"Uncle, what do you suppose the head clerk, Jones, has been telling people about me?"

"I have no idea."

"He has been telling everybody that I am a fool."

"I will see him about it and tell him to keep quiet. He has no right to expose the secrets of the office."—*Texas Siftings.*

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What Is "Accuracy"?

There are many descriptive terms used in catalogues of machinery builders and elsewhere, which, while they sound very well, and as though they ought to have some definite meaning, really have absolutely no meaning whatever, and it seems to us there could be some little improvement in this respect which would result in good for all. For instance, just what idea is conveyed by the term "accurate" or "first-class workmanship" when used by a manufacturer in describing his machine? Different manufacturers have widely variant conceptions of accuracy, and a job that one would call very accurate would certainly fall far short of passing the inspectors of another manufacturer. And a further fact is that it often happens that the machine turned out by the manufacturer having the highest standard regarding accuracy and good workmanship goes into the hands of a user who knows next to nothing about such work, and *vice versa*. We all know that we can buy lathes or planers, for instance, of about the same weight and general appearance, at prices varying by as much as 50 per cent. at least, and the maker of each will describe them as being constructed with the highest degree of accuracy, and that the workmanship is first-class throughout. Each may be entirely honest, but the ideas of the two men as to what constitutes an accurate machine are totally different, while the ideas of a prospective purchaser may be lower or higher than either of them.

A drill press may be sold for an accurate machine, and in nine cases out of ten go into the hands of men who will never know whether it is really accurate or not; it does their work good enough, and that is sufficient. But the tenth man may need a really accurate drill press, and may therefore put a sweep into the spindle, and determine just how much the table is out of square with the spindle. Then when he writes to the manufacturer complaining that his "so-called accurate drill press" is out .003", he gets a reply full of virtuous indignation, and wanting to know "what you expect for a hundred dollars?" and, furthermore, presenting the knock-down argument, that "we have sold these drill presses for years to the best known concerns in the country, and yours is the first complaint we have ever received in respect to their accuracy."

Now the real truth is that the nine men do not need a drill press of the highest attainable accuracy, and would refuse to pay a fair price for such a machine, while the tenth man should expect to pay more than the others, simply because he wants a thing of greater intrinsic value. It seems to us that it would be better for all concerned if tool builders, especially, would always specify what they mean by the terms "accurate" and "first-class work," or, what would perhaps be better, do away with such terms, and specify in decimal parts of an inch just how much variation from absolute accuracy is permitted in the construction of the machines. By this plan those who were looking for any certain grade of workmanship in a tool could definitely know what they were buying, and those who were really doing the best work would get credit for it, and, we hope, money proportionately. We would go further than this, and imitate to some extent the watch manufacturers. We all know that tools require some adjustment upon the floor. In lathes, for instance, the spindles must be brought into accurate alignment, if at all, by skilled workmen provided with means of testing and correcting defects until practical perfection is reached. This process, if thoroughly done, is usually expensive, and for many purposes for which lathes are used is entirely unnecessary and superfluous. There is no reason why the man who does not need this refinement should be compelled to pay for it in order to get the lathe which, in other respects, suits him, while the man who really needs the highest accuracy should be able to get it in almost any make of lathe he may choose, by simply paying a somewhat higher price for the extra cost of the adjustment. If we are buying iron or steel, the amount we pay for is definitely stated in pounds; there is as good reason, when we are paying for accuracy in machine construction, that the degree of accuracy should be specified in equally definite terms. Of course, for the protection of the manufacturers, machines so made should be graded and marked by grades, so that a lower grade machine may not at any future time be taken to represent the maker's best practice.

Watch manufacturers often make and sell watches precisely alike, except that some are adjusted to temperature and position, while others are not, and they charge corresponding prices. Why should not tool builders do the same, or an analogous thing?

Flying Machines.

Information reaches us through a reliable channel that Mr. Hiram Maxim's experiments, which he has been carrying on for some time in England, with a flying machine, are, for the present at least, at an end, no flying having yet been done, and the capitalists who were backing the enterprise having grown tired of the expense.

It will be remembered that Mr. Maxim some time ago gave some account of what had been done, in the *Century Magazine*. His article was modest in tone, and he refrained from doing much more than merely giving an account of what had been done; but it was all the more encouraging on that account, and there were undoubtedly very many who entertained great hopes that Mr. Maxim would be able to construct a machine that would fly. He may do it yet, but the present abandonment of his experiments does not look encouraging.

It seems more than probable that if aerial flight is ever accomplished it will be done at a greater expenditure of power than would be required to transport the same loads at the same speeds by present means, but there would be, of course, great advantages in flight, which, for many purposes, would overbalance considerations of economy. It is quite certain that any device that requires a considerable expenditure of power merely to maintain its altitude or distance from the earth, must be at a great disadvantage as compared with present means of transportation, in which no power is required for this except that incidentally expended in overcoming friction introduced by the wheels and axles which maintain this altitude.

It will be recalled, doubtless, that Mr. W. H. Harrison has expressed the opinion in these columns that this wheel and axle arrangement was the ideal flying machine, and though the progress of a wagon over the surface of the earth cannot be considered very closely analogous to flying, it may turn out to be about the closest approach to it that we shall attain. Nevertheless, all efforts to perfect a flying machine are not, of course, at an end, and intelligent perseverance often accomplishes wonders.

Another Dynamite Thrower.

What may be accomplished by determined persistence and intelligent study is shown by the recent success of Dr. Justin in throwing from an ordinary cannon, by charges of powder, shells charged with 6½ pounds of nitroglycerine, which did not explode until they had struck and penetrated the target.

A year or more ago we noted that Dr. Justin had make some experiments of this kind, in which the most notable effect was an explosion of the shell's contained charge within the gun, and at the moment of firing, the gun being, of course, demolished. There were several repetitions of this experience, but his efforts seem now to have been crowned with complete success.

It was found that one of the main causes of the previous premature discharges was the quickly imparted rotating movement of the outer shell, which, as the inner shell containing the high explosive could not be so quickly set in motion, caused friction and heat sufficient for ignition. This has been remedied by the use of wood for an interior lining, and by so arranging the two parts of the shell that the inner case takes up the rotary motion very slowly.

Upon striking, the inner shell plunges forward and is detonated.

While this is, of course, a triumph of mind over matter one cannot but think that such a warfare as would be carried on by such means would be barbarous. If we remember rightly there was in days gone by considerable sentiment among civilized nations against the use of chain shot, because it was considered cruel and barbarous, but chain shot would not be a circumstance as compared with a shot containing 6½ pounds of nitro glycerine. The one hope is that we shall keep on until war is made impossible, or reduced to a contest of machines with machines, each destroying property but no lives.

Squaring the Circle.

The ever-present individual who thinks he has or can "square the circle," should read in the Annual Report of the Board of Regents of the Smithsonian Institution, for 1890, Mr. William C. Winlock's paper that subject. If this does not cure him nothing but time and experience, or death, will do it.

The paper opens with the information that the problem is two and a half thousand years old; that the French Academy in 1775 passed a resolution not to examine any more so-called solutions of it; that it has been repeatedly demonstrated by rigid mathematical processes to be impossible; and finally, "that the race of circle squarers, unmindful of the verdict of mathematics, that most infallible of arbiters, will never die out so long as ignorance and the thirst for glory shall be united."

Literary Notes.

We have received the initial number of *Milling*, which is a new illustrated monthly magazine devoted to the flour interests, grain, etc. In respect of printing, illustrations, and subject matter, it is very high grade, and we should think would be generally appreciated by those in any way connected with milling interests. We find in it articles pertaining to the technical and commercial aspects of the business, and much well selected literary matter besides. It is published by D. H. Ranck Publishing Co., Indianapolis, New York and Chicago, at $2 per year.

Those who are interested in railroad matters will find in the Annual Report of the Board of Regents of the Smithsonian Institution, Report of the National Museum, a paper on "The Development of the American Rail and Track, as illustrated by the collection in the U. S. National Museum, 1889," which is of great value and interest. The paper, which is profusely illustrated with engravings, showing a great variety of forms of rails and track, has been prepared by Mr. J. Elfreth Watkins, Curator of the Department of Transportation and Engineering.

A writer in the *New York Times*, in describing the plant of the Newport News Shipbuilding Co., says:

Following the same general plan of progression, a novel innovation in marine construction has been introduced at the yard. In building a vessel it is the custom of European shipbuilders to begin amidships after the keel is laid and work towards both ends. But the Newport News shipbuilders follow no pattern from across the water. Their method of constructing a ship greatly simplifies the task and dispenses with a great deal of unnecessary lifting of plates and frames. Hydraulic traveling cranes of forty tons capacity swing the heavy plates and frames into position for riveting direct from the transfer cars. As the ships are launched stern foremost, the after frames and plates are the first to be put in place. It can readily be understood how much unnecessary labor this method of building up from the stern does away with.

Now, though it is said that this "can be readily understood," we must confess we are entirely unable to understand it, and an explanation, diagram or something would seem to be in order.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(264) W. E. P., Brooklyn, N Y., writes: Please inform an old reader if there is a rule for finding the spiral of a cutter. I have some spiral mills to recut, but I do not know how to find the spiral. One of the mills is 2 inches in diameter and one inch thick. *A.*—There is no rule for finding the angle of the spiral; we should adopt from 10 to 15 degrees; this angle is usually sufficient; if much greater, the end thrust on the spindle will be increased to an extent not desirable for some machines.

(265) J. W. S., St. Paul, Minn , writes: Please inform me through your columns whether coal oil is a good thing to use in steam boilers to prevent the formation of scale. The water is hard, and contains a good deal of lime. I have a 50 horse power boiler; how much should I use at each cleaning, say once a month, or could you inform me of something better? *A.*—Kerosene is frequently used with good results. Use about one pint each day, blow off two gauges every week, and the entire contents every month.

(266) J. A. H., Augusta, Ga., writes: We are building a steam wheel boat with cylinder 8 inches diameter, 36 inches stroke, to make 30 revolutions per minute, with 140 pounds boiler pressure. What should be the width of the steam ports, exhaust port, width of bridges, length of ports, exhaust and steam lap, travel of valve, diameter of piston rod and thickness of metal in cylinder walls? *A.*—Steam ports, $\frac{3}{4}$x5 inches; exhaust port, $\frac{3}{4}$x5 inches; width of bridges, $\frac{3}{4}$ inch; outside lap, $\frac{3}{4}$ inch; inside lap, $\frac{1}{32}$ inch; travel of valve, $2\frac{1}{4}$ inches; diameter of piston rod, $1\frac{7}{16}$ inches; thickness of cylinder walls, $\frac{9}{16}$ inch.

(267) M. J. K., Troy, N. Y., writes: Please give me the size of blower and engine required to run a furnace for melting brass. We are starting a brass foundry, and want to turn out work at short notice; expect to get much experimental work. If you should not advise us to use a blower, what height of chimney is required for rapid melting? *A.*—You do not need a blower. The size of chimney will depend on the size of furnace. We should make the cross sectional area of the chimney equal to one eighth of the grate area in the furnace, and the height of chimney not less than 20 feet; it need not be higher than 30 feet.

(268) W. C. B , Fayetteville, N. C., writes: Will you please help me out of a bad situation? I am building a 20-inch by 8 foot pattern makers' lathe all of iron, and I can not find the correct diameters of the different steps on the cone pulleys The cones are to be alike, of four steps each; the largest one is $14\frac{1}{2}$ inches, and the smallest 5 inches diameter. Please send me the correct measurements. *A.*—You can easily determine the diameters of the steps by the graphical method explained in our issue of December 1, 1888. For great accuracy we should advise you to use a full size construction for the solution of the problem.

(269) J. S. W., St. Albans, Vt., asks: How can old rubber be ground into a powder so that I can mix it with gutta-percha cement for the purpose of putting it in a wooden mold, and let it dry and become as hard as the common rubber used in overshoes? If I can get at the grinding process, I think I have a good thing in my brain to improve rubbers, so that we will not be so liable to fall down and almost crack our heads or break other parts of our bodies. If rubber can be ground, where can I get a mill that will do the grinding? *A.*—It seems to us that you will have quite a good time to grind old rubber to a powder. There are machines for cutting or masticating into a mass of a consistency resembling putty, but we do not know of a process which will reduce it to a powder.

(270) Rustic, ——, Tenn., writes: Please answer through your columns the following: What is the best thing to put in a boiler to break the scales from the tubes, as well as from the boiler, that have been there for some time? *A.*—In recent years kerosene oil has been very extensively used for the removal and prevention of scale, with satisfactory results in many cases. We should advise you to use one quart of kerosene oil per day for a 100 horse-power boiler, and about a proportional amount for other sizes. The water should be blown down two gauges every week, and the entire contents every month. Rubber packing around water glass gauges, and kerosene oil, do not agree. Use asbestos wicking dipped in boiled oil and then squeeze dry for packing. A month's trial should give evidence of its efficiency.

(271) W. W. R., Norfolk, Va., writes: We have driven four $2\frac{1}{2}$-inch wells, 90 feet, but we get very little water say 15 to 20 gallons per minute, and what we get is somewhat affected with salt, and I think a small per cent. of other impurities. We have two tanks, 15 gallons each, and this water is pumped into them before it is used. We use the returns from our dry kilns, and also all the exhaust we can take. We have more or less of this salt collection all around the pipes of our boilers, and pipes throughout our plant. Is there any way to drive this saline matter to the bottom of the tank, or in any way destroy this matter without its being taken in our boilers? I have heard that there was some preparation that could be put in the tank to drive this substance to the bottom. If you can give me any light on this subject, it would indeed be greatly appreciated, as I want to get to the bottom of this matter, and I know no better way than the one I have attempted, namely, through the AMERICAN MACHINIST. *A.*—We do not know of any compound that would cause the saline matter and other impurities in the water to settle at the bottom of the tanks. But there are feed water purifiers made that we believe will answer your purpose perfectly. They are placed between the boilers and the pump, and the water flowing through them is subjected to the direct action of the steam, is heated to the boiler temperature, and parts with the scale-making properties it contains before it enters the boilers; in fact, the water is practically pure.

(272) C. W. S., Fremont, Neb., writes: Inclosed please find drawing of a slide valve and ports of which I would like your opinion as to how it can be improved. It had originally $\frac{1}{4}$ inch less steam lap, and by putting on the extra lap I made quite a saving in steam. The valve does not leak, but the exhaust sounds as though the steam was going right through all the time. *A.*—We have good reason for believing that you did not send us a correct drawing; you show nearly as much inside lap as outside lap. If the valve is really made like your drawing we should advise you to lose no time in having the valve reconstructed by a first-class engineer. 2. In putting up 1,500 feet of 1 inch heating pipe 75 feet away from the boiler, how large a feed should be used to connect to boiler? Some claim that a 2-inch pipe should be used, but I think that a $\frac{3}{4}$-inch pipe is large enough, as the steam would get there quicker with less condensation. *A.*—We do not understand how you can expect steam to flow quicker through a $\frac{3}{4}$-inch pipe than through a larger one. The loss of steam through small long pipes by friction and condensation is very uncertain; they will supply steam with a much reduced pressure at the heater. For a pressure of 50 pounds in the boiler we should use a $1\frac{1}{4}$-inch pipe, or not less than 1 inch. 3. What is the address of the De La Vergne Refrigerating Machine Co.? *A.*—East 138th street, New York. The address of the other party we do not know.

(273) J. C. B., Brooklyn, N. Y., writes: Kindly inform me through your columns of a quick and good way of japanning small work, such as small rings as sample enclosed, and nails with large heads, such as are used by coach trimmers. Dipping and placing them on a tray and handling marks them badly. *A.*—It seems to us that by hanging

Fig. 1.

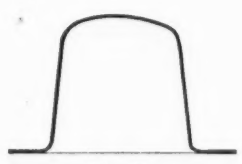
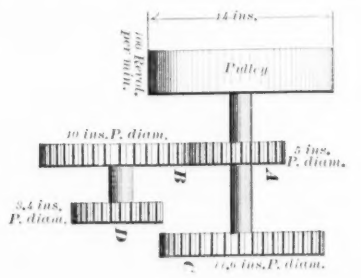


Fig. 2.

the rings—after the varnish has been applied—on a suitable rod with a knife edge, this edge bearing against the inner side of the ring, and then the whole placed in the oven, should not leave an injurious mark, particularly if the operation is repeated several times, as is required for good japanning. For the nails we should use a wire netting, with the bottom of the heads resting on it; this will enable you to apply the varnish quickly to a great number at a time, without handling any of them after they are varnished, the whole being placed in the oven. Of course these are only suggestions; experience will indicate any modifications that may be necessary in these plans. Great skill is required in laying on the coats of varnish; if possible, the brush should never cross or twice pass over in giving one coat. 2. The accompanying cut represents a tip finished, now in the finishing die. I leave this straight, and trim off in a lathe rigged up for the job, but it is a very long operation. Could I flange it out as shown in Fig. 2, and then trim it through a die at any saving, or can you give me a better way than mine? *A.*—We hardly understand your question; in any case you have not given us sufficient data for answering your question correctly. For instance, what finish do the tips require? What kind of metal are they made of? For what purpose are they to be used? Is the flange required after they are finished? Neither do you state how your lathe is rigged, so as to enable us to suggest improvements.

(274) Mechanic, Philadelphia, Pa., writes: 1. What increase of power does back gearing give to a machine where it is used? *A.*—The use of back gears does not give an increase of power; the advantage gained will be the capability of overcoming greater resistances but at a sacrifice of speed; the force which produces motion, multiplied by the distance through which it acts, is always equal to the resistance multiplied by the distance through which it is overcome; or, in short, the energy exerted is equal to the work performed. 2. Please give a solution and explanation of the following example: What increase of power will the back gear give, there being 40 pound pull per running inch of belt, and the gears arranged as shown in the sketch? *A.*—According to what has been said above, no power is gained by this arrangement; to find the advantage we shall, for simplicity, not take into account any hurtful resistance, but shall assume that all the energy is expended on useful work, and that the circumference of the pulley is subjected to a direct pull of 40 pounds net. The circumference of the pulley is 3.66 feet; hence its surface speed per minute will be $3.66 \times 100 = 366$ feet, and the energy exerted, or the power transmitted, will be $366 \times 40 = 14{,}640$ foot-pounds per minute. Since we have assumed that there is no energy expended on work wasted, the pinion *A* must also transmit 14,-



640 foot-pounds. The circumference of this pinion is 1.308 feet, and the speed of its circumference is $1.308 \times 100 = 130.8$ feet; consequently the *force* which it will transmit to the wheel *B* will be $\frac{14640}{130.8} = 111.92$ lbs.; hence the wheel *B* can overcome a resistance of 111.92 pounds applied to its circumference at a reduced speed of 130.8 feet per minute. The foregoing shows that the force transmitted by the pulley *B* is inversely as its speed; remembering this, the same result can be obtained in a much simpler manner. For instance, the speed of the pinion *A* at its circumference, and consequently that of *B*, is $\frac{5}{14}$ times that of the circumference of the pulley, and therefore the force which the wheel *B* can transmit is $40 \div \frac{5}{14} = \frac{40 \times 14}{5}$ $= 112$ pounds. This result is very nearly equal to the first one, and had the decimal in the latter been exact there would have been no difference in the results. If now the wheels *D* and *C* are put in gear then the speed per minute of the circumference of *C* will be $\frac{11.6}{14}$ times that of the pulley, and the force which *C* or *D* can transmit will be $40 \div \frac{11.6}{14} = \frac{40 \times 14}{11.6} = 48.27$ pounds. But in each case the work done is equal to the power or energy exerted. 3. In answer to Question 214, of May 12, 1892, from what source do you get the $3\frac{1}{2}$ horse-power? I cannot see how it is derived from the problem as stated. *A.*—If you read the question carefully you will see that the $3\frac{1}{2}$ horse-power is a quantity given by the correspondent.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant Gear Wheels, Gear Cutting, page 20.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

A. D. Pentz, Consulting. Tools. Elizabeth, N. J.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

Pattern and Brand Letters. A variety of sizes and styles Heber Wells, 8 Spruce St., New York.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

S. A. Smith, 23 S. Canal St., Chicago, Ill., is agent for Holbrook's new loaded rawhide mallets.

Automatic Gear Cutters. Best in the market. Superior Machine Works, 106 Canal St., Cleve'd, O.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., cor. Canal and Washington Sts., Chicago, Ill.

Patterson, Gottfried & Hunter, Limited, 146-150 Centre st., New York, are putting on the market a new alarm speed indicator. Send for circulars.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

25" / 33" / 37" / 42" — "Only Drill Press built on 'Ko rekt' principles, Even if they come from Jersey." Gould & Eberhardt, Newark, N. J.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

Just Pub.—Safety Valves, History, Invention & Calculation. By W. B. LeVan. Fully ill. $2. Cat. of Machinists', Electricians' & Engineers' books sent free. N. W. Henley & Co., 150 Nassau St., N. Y.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 25, 1886 issue; must be unsoiled, and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Twenty-fifth Annual Convention.

(*Continued from page 5.*)

ing we have been presented with additional evidence contained in the report of this committee. It is presumed the committee went at it in an entirely unprejudiced way. I have taken for example the two groups of tests made with the simple engine with a pressure of 180, using Braceville coal. I have taken the consumption per ton per mile, and find it is 1.029 ton per mile I have taken the compound and find it burnt 1.018, making an economy of 8½ per cent. in that group of tests. I would venture to say that any gentleman here present having charge of the locomotives of a railroad might make that difference in two simple engines by painting the smoke-stack of one sky blue.

During the discussion Mr. Dolbur made some remarks as pertinent as any heard. He showed that in actual use the economy of compound engines over which he had control varied all the way from about 35 per cent. to *minus* 7 per cent., and that prejudice had a good deal to do in the matter.

The arriving at exact results in ordinary locomotive practice is a matter of extreme difficulty, about which we may have more to say in a later issue. The report of the committee, and the discussion it brought out was valuable, as indicating a way of settling the vexed question.

TESTS OF STEEL AND IRON.

The comparative value of steel and of iron has engrossed the attention of railroad mechanical men for some years, and it is apparently about as far from being settled as it ever was. The committee had evidently done faithful work, but it was met at all

points with the difficulties inherent to a settlement of the relative values of the two materials. It may be said, in a general way, that in regard to steel *versus* iron tubes, that there was the same diversity of opinion as in the use of the two materials for other purposes. The committee reported, in part:

We are, however, advised that in the case of a large number of steel tubes the results, so far as wear is concerned, have been unfavorable. The following definite experiment, however, has been made. An engine was equipped with 114 iron tubes and 113 steel tubes on December 20, 1890. The iron tubes were placed on one side of the center, and the steel tubes on the other side of the center of the boiler, the flues being divided by a vertical line through the center of the flue sheet. On March 9, 1892, the flues were all removed. Seventeen of the iron tubes arrangement gives in vibration a full motion of three thirty-seconds of an inch at the end of the stay bolt, and at the same time allows a stress in the direction of the length of the stay bolt somewhat similar to that which occurs in boilers, the strain put on the stay bolt being equivalent to a pressure in the boiler of 150 pounds per square inch. A test was made in this way of four pieces of mild machinery steel; the average number of vibrations before breakage was 21,539, the pieces standing respectively7, 950, 96,060, 14,168, and 54,358 vibrations before breaking.

Eleven samples of iron were tested in the same way, the average number of vibrations before breaking being 6,568, the lowest being 3,120, the greatest 12,480. The result of these tests would indicate that steel is a better material for stay bolts than iron; at the same time the experience of a number of members of your committee with steel stay bolts has been seriously against them. They failed in service, and deductions drawn from the test, as made, are entirely misleading. Your committee does not feel that in this they have added anything to the subject of a proper method of determining the suitability of any special material for stay bolts.

The investigation, as described above, is not sufficient to enable your committee to offer any specific directions for drawing up specifications for iron and steel for fire box purposes, and they therefore have in this particular no definite recommendations to make.

The results of the investigations so far may be summarized as follows:

1st. Steel or iron should not be worked at a temperature between a normal temperature and a perceptible red heat.

2d. So called "blue heat" makes steels and irons more brittle, but some are apparently less affected by the "blue heat" than others.

3d. The test of steel or iron at a "blue heat" is not a criterion by which to judge of the action of the same in a fire box.

4th. Iron at a blue heat is more seriously affected than steel.

5th. There is apparently a mechanical disintegration going on in plates exposed to the action of fire, water and scale in a fire box.

6th. Steel tubes do not seem to be as durable as iron tubes.

Your committee recommends that, owing to the importance of the subject and the great value to railroads of further knowledge of the relative merits of iron and steel, this subject be continued for another year at least, and that the co-operation of all members of the association be asked, in order that all experiments and experiences of the members be made available to hasten the acquirement of definite knowledge of practical value.

On Wednesday morning the association met for its last session.

STANDARD BOLTS AND NUTS.

The committee on this subject reported substantially the United States standard, with the recommendations as to the equal size of rough and finished nuts and bolt heads that have so frequently been recommended for machine shop practice. The usual argument was brought out, in discussion, that those in charge of mechanical matters on railroads would not adhere to the standards before proposed. Some men in charge case-hardened the rough nuts just as they came to them, and so secured practical uniformity of (so-called) rough and finished nuts. The committee had evidently worked faithfully, and made the best report possible under the circumstances. If the master mechanics follow the suggestions and recommendations made they will not go astray, we think.

CONSTRUCTION FOR HIGH BOILER PRESSURE.

But little was brought out on this. The matter was too indefinite. More space for stay bolts to cover was recommended, and the reduction of size of stay bolts between sheets was shown to be advisable. The question of the use of iron or steel for stay bolts was discussed, without anything definite in the way of conclusions.

Various matters were considered—some of which have been omitted in the previous brief report—and which may be referred to in future issues, when the election of officers came up.

For president, Mr. John Hickey was selected; for first vice-president, Mr. William Garstang, and for second vice-president, Mr. R. C. Blackall. The unanimous vote of the association was cast for Mr. O. Stewart for treasurer, and for Mr. Angus Sinclair for secretary.

The Champion Die and Collet.

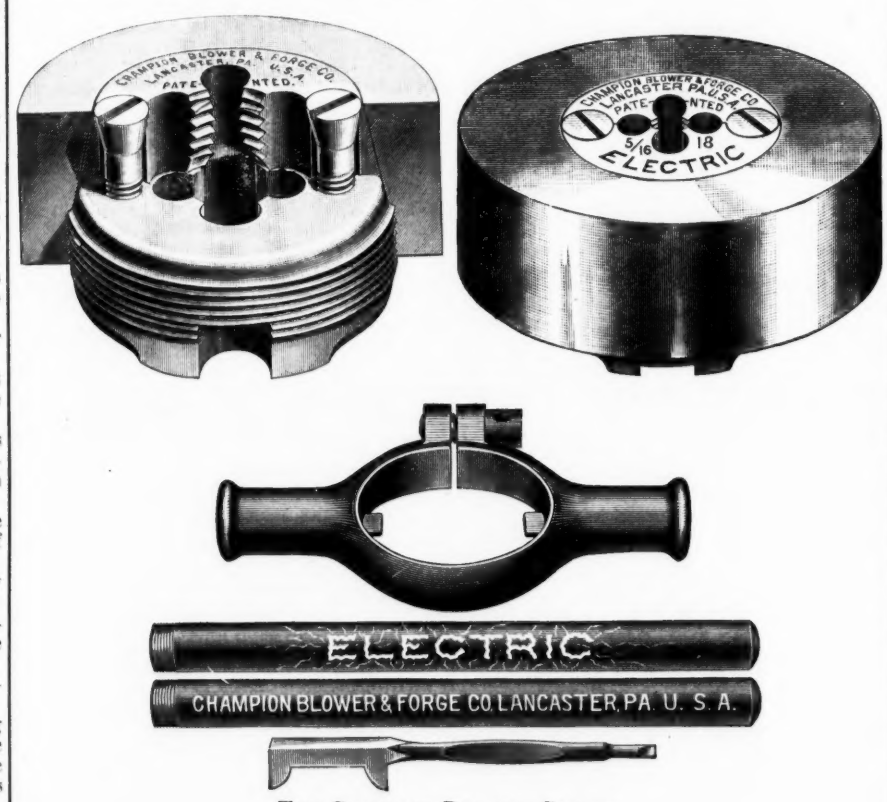
We present with this engravings of a new die and die-stock, the die being so made as to be readily adjusted, and yet be practically solid when cutting.

The sectional view of the die and collet will make the construction plain, it being here seen that the die is in two parts, the outer edges being tapered to fit the inside of the collet as shown.

The guide, which is below the die, is in the form of a threaded disk, which screws into the collet by a spanner wrench, and thus forces the die firmly to its seat, the size the die will then cut being determined—within the limits of adjustment—by the two taper head screws shown, which tend to separate the two parts of the die. This gives sufficient adjustment to allow of cutting threads on rough iron, and there is no chance for chips to get into the die in such a way as to interfere with its proper working. The construction of the stock will be readily understood from the engraving, and it will be noticed that when the die is in place and ready to cut, everything is solid and firmly held in place.

The stocks are made in three different lengths—14¼, 23 and 26 inches, and the dies are furnished for any kind of thread from ¼" to 1".

The manufacturers are the Champion Blower and Forge Co., Lancaster, Pa.



THE CHAMPION DIE AND COLLET.

The Trolley Wire.

A prominent manufacturer of Hartford sends us two copies of a Hartford paper containing an account of the killing of a horse by a broken trolley wire, and also of a lineman who attempted to right matters before the current was shut off. The current, in fact, was not shut off for about an hour and a half after the first request to do so, because "*the superintendent had given orders to run the power until a certain hour, and they were going to do it.*"

The manufacturer alluded to writes:

I see in your issue of the 16th inst. an article defending the trolley system of street car propulsion. This city has had a struggle to keep this system out of the main streets of Hartford, but the horse railroad company finally succeeded in getting in a suburban service. The village of East Hartford, through which it was to run, also objected—finally they were overpowered, and the trolley system now runs from the City Hall to a village four or five miles distant. Three days since, a fatal accident occurred, a full account of which you will find in two local papers I send you to day. The people here do not intend to go crazy over the imperfect trolley system, and are quite content to wait until something better is developed—in the meantime, use horses. But we will not be obliged to wait long. We will soon see cable cars and trolley system go out, and safer, cheaper, and better system take their places; but if we made no objection, and were content with the present systems, improvements would come slowly, if ever.

A contemporary, in attempting to account for the high cost of the high-grade bicycle, says first that it must be made on the interchangeable principle, so that parts broken or worn out may be replaced, main parts being gauged and kept within a limit of variation of one-quarter thousandth. Finally, according to this authority, "The day has not yet come when it [the bicycle] can be made factory fashion."

To say that interchangeable parts increase the cost of a machine is something new, but that a machine made by the interchangeable system cannot yet be made "factory fashion" is wonderful.

In 1876 the German Government owned 27 per cent. of all the German railroads, in 1881, 57 per cent., and at the present time 87 per cent.

The Massachusetts Institute of Technology has issued a pamphlet giving time, place, and other information relating to the entrance examinations for the coming year. For the convenience of those desiring to become students, the examinations are to be held in all the leading cities, the circular referred to giving particulars.

MANUFACTURES.

Another iron-mill is talked of for Richlands, Va.

The Chicago Tire and Spring Company is enlarging its plant.

Nichols Brothers will erect a new forge shop at Greenfield, Vt.

The new steel plant at Chester, Pa., is rapidly nearing completion.

The Eclipse Wind Engine Works at Beloit, Wis., are being enlarged.

An electric railway power house will be erected at Lancaster, N. Y.

Union Foundry and Machine Works at Frederick, Mo., will be enlarged.

There is a possibility of a smelting foundry being established in Toronto, Ont.

Capt. W. H. Moore is about to establish a machine shop at McKeesport, Pa.

W. D. Troutner will build a new machine shop, foundry, etc., at Pittsfield, Ill.

The Clipper Chilled Plow Company will erect a new building at Elmira, N. Y.

The Vulcan Foundry Company has just been organized in Providence, W. Va.

Dennis J. Kelley, of Troy, N. Y., has established a brass foundry in Pittsfield, Mass.

The Eureka Iron and Steel Works of Wyandotte, Mich., may erect a new steel plant.

W. J. Carter & Brothers' recently burned iron works at Dublin, Ga., are being rebuilt.

It is stated that the Cohannett Mills Company, of Taunton, Mass., may erect a new building.

The Wollaston (Mass.) Foundry Company will immediately rebuild its recently burned plant.

R. J. Biggs and J. P. Saunders are erecting an iron foundry and machine shop at Bardwell, Ky.

Work has commenced on the foundry and machine shop of the Ashland (Wis.) Foundry Co.

The North Star Iron Works is busy removing its plant from Spring Valley, Minn., to Griffith, Ind.

The Plattsburg (N. Y.) Milling Company has been incorporated. Henry Davis and others directors.

Coleman Shields & Co., Niles, O., are offered $25,000 and 12 acres of land to move to Girard O.

The Bentonville Hardware Company has been incorporated, at Bentonville, Ark.; capital, $15,000.

The Richmond (Va.) Railway and Electric Company is building a new plant on Johnson's Island.

There is a possibility of a concern's establishing the manufacture of nailless horse shoes at Buffalo N. Y.

Some great improvements are being made at the plant of the Youngstown Steel Co., of Brier Hill, O.

The Rochester Medina Stove Company is a new $15 000 concern at Albion, N. Y. T. A. Smyth is a director.

The Green Company is a new $200,000 concern to manufacture ventilating apparatus, at Jersey City, N. J.

A boiler works will shortly be built in Aliquippa, Pa., to be completed by fall, and employ several hundred men.

The capital of the J P. Hall and Torpedo Boat Company, of New York, has been increased from $150,000 to $250,000.

The Boise Foundry and Machine Company have been organized at East Liverpool, Ohio, with a capital stock of $50,000.

The Globe Stock Car Co., of Chicago, has been organized by Arthur W. Street, John F. Pershing and John W. Waughon.

A contract has been signed for the erection of a big plant at West End, Ala., for the manufacture of machinery, to cost $100,000.

The machine business of the firm of White & Bailey, at Peabody, Mass., recently dissolved, is to be continued by W. E. Bailey.

The International Steam Power Company will establish the manufacture of patent boilers, steam heaters, etc., at Olean, N. Y.

Citizens of Randolph, N. Y., want to establish a foundry, and will give the necessary land if outside capital will go into the enterprise.

The John L. Gish Ideal Rheostat Co., of Jackson, Mich., is incorporated, to manufacture the Gish rheostat and electrical appliances.

The Mount Joy (Pa.) Grey Iron Casting Company is making extensive improvements about its plant, besides erecting additional buildings

The iron frame work of one of the two mills of the Sterling Steel Co. in McKeesport, Pa., has been raised. The building will be 75x100 feet.

The Maryland Manufacturing Company, Baltimore, Md., is equipping a plant for the manufacture of rivets, stoves, tires and sink bolts.

The Maryland Brass Co., Baltimore, Md., has purchased additional ground, and will in the fall enlarge its brass foundry and machine shops.

The Western Car Spring Company, of Chicago, has been incorporated, by Geo. E. Marden, C. S Burden and others. Capital stock, $250,000.

A company has been formed for the erection of a cotton-mill at Nicholsonville, N. C. O. M. Baker, treasurer, of Shelby, will furnish information.

The Westinghouse Air-brake Company will make additions this summer to its plant at Wilmerding, giving employment to several hundred workmen.

The recent purchasers of the Hickey brick plant at Le Mars, Ill., will add new machinery and start the manufacture of brick and tile on a large scale.

The Lake Roland Elevated Railway Co., Baltimore, Md., has let contract to the Thomson-Houston Electric Co. for outfit for its electric power plant.

General Manager Doddridge, of the St. Louis Southwestern, has agreed to build car shops at Pine Rock, Ark., if that town raises a bonus of $25,000.

A. Egerton Adams, Carl Jernberg and O. W. Modeen have formed the Chicago Machinery and Iron Company. The capital stock is placed at $50,000.

The Crystal Washer Company has purchased a site at Easton, Pa., will erect a washing machine factory, and equip it with the latest improved machinery.

T. E. Byrd, N. E. Sherman and J. M. Midget, have chartered the Lone Star Engine and Boiler Works, with a capital stock of $50,000, at Greenville, Texas.

Gould & Eberhardt, Newark, N. J., inform us that they are receiving very flattering orders for their improved automatic machine tools for electrical and other works.

The New York Manufacturing Company's buildings, which are to be located above Harrisburg, are to be erected by the Pennsylvania Steel Company. They will be 220x208 feet.

Negotiations are under way for the removal of the greater part of the Vulcan steel plant at Carondelet, St. Louis, to Alabama, where it is expected that the basic process will be used.

J. Mathews, South Bend, Ind., boiler manufacturer, has accepted the offer of the wide-awake industry-lifters, of Harvey Ill., Chicago's pushing suburb, and will remove to that place.

It is reported that a number of Pennsylvania capitalists have purchased large tracts of land at Rocky Mount, N. C., for the purpose of establishing manufacturing and other industries.

E. S. Nixon, J. B. Harris, Charles F. West and others have applied for a charter for a company which they propose to organize at Chattanooga, Tenn., for the manufacture of hardware.

The Laflin & Rand Powder Co., of New York, has purchased 320 acres of land at Boyle's Gap, Birmingham, Ala., and will erect thereon a $400,000 plant for the manufacture of blasting powder.

The Lewis Foundry and Machine Company, Limited, of Pittsburgh, have closed a contract with the Cumberland Tin-plate Company, of Cumberland, Md., for a large lot of tin-plate machinery.

The Murray Bicycle Speeder Company, to manufacture an improved bicycle attachment, has been incorporated at Harper's Ferry, W. Va. Capital stock, $42,000, with privilege of increasing to $50,000.

The Northwestern Equipment Co., manufacturers of the "Kewanee" rectangular brake beam, has just completed its plant at Chicago, where it will have a manufacturing capacity of 600 beams a day.

The Detroit Lubricator Company, which controls the patents of the Hodges steel cars, propose to locate works at Birmingham, Ala., provided that soft steel in sufficient quantities is manufactured there.

It is rumored that a large plant will be erected in New Castle, Pa., to manufacture all kinds of springs and continuous mills. C. H. Morgan, Sr. and Jr., and V. E. Edwards are especially interested.

The Richmond Safety Gate Company, Richmond, Ind., manufacturers of Zeller's automatic safety gate for elevator openings, are erecting new quarters, into which they expect to move about August 1.

The Philadelphia & Reading has begun work on the erection of a large car repair shop at Wayne Junction, Philadelphia, to replace that recently destroyed by fire. It will be a brick structure, 176 70 feet.

The Edison Electric Light Company of West Chester, Pa., is preparing to increase the size and facilities of its plant. A new annex for the reception of a new dynamo, engine and boiler will be erected.

The work of building the structure for the gun foundry of the Bethlehem (Pa.) Iron Company is progressing rapidly. It will be 1,000 feet long, and contain the machinery for the fabrication of the finished guns.

The plant of the insolvent Deoxodized Metal Company, at Bridgeport, Conn., has been sold to F. W. Smith, one of the largest creditors, who will organize a new company to operate the works on a larger scale.

The National Tubular Axle Company has been formed at Emigsville, Pa., for manufacturing articles of iron or steel, or both, etc.; capital, $30,000; incorporators: Wm. H. Emig, Horace Brillinger and E. K. Emig.

Curtis & Curtis, of Bridgeport, Conn., have been awarded the contract to furnish some of their large power pipe-threading machines for use in the navy yard at Boston. These machines will have a range for threading pipe from 2½" to 8" diameter.

Plans have been completed for the new machine shops of the Queen & Crescent to be built at Meridian, Miss., to replace the shops recently burned, but they will be larger and more complete than the old shops, and will cost about $50,000.

The work of fitting up the plant of the Owego Bridge Company, Owego, N. Y., is gradually approaching completion, and the manufacture of iron bridges will soon be commenced. The company has already contracted for building six or eight bridges.

The Stewart Wire Company has been incorporated in Easton, Penn., to succeed Stewart & Co., owners of the extensive wire mills there. The plant will be enlarged and the number of hands increased to 500. The company has a capital of $400,000.

Geo. Davis, J. N. Carnes and J. R. Guard, of Charleston, W. Va., and E. B. Bruns and Payton Edwards, of El Paso, Tex., have chartered the El Paso Electric Co., with a capital stock of $100,000. Franchise has been secured and plant will be built at once.

The McKinley Tin-plate Company, at Wilkinsburg, Pa., is about ready for operation. The machinery is now being placed in the building, and the company will make a specialty of roofing tin. It has been decided to increase the capital stock to $50,000.

Representatives of the firm of Mather, Platt & Co., of Manchester, Eng., are reported as negotiating with a view to establishing a branch of the manufacture of finishing machinery for bleaching and dyeing textile fabrics, in either Providence or Pawtucket, R. I.

The Track Signal Company, of Detroit, has just been organized, and will engage in the manufacture and sale of the Parish track signal. The officers are Frederick P. Anderson, president; A. G. Boynton, vice-president; Dr. Phil Porter, secretary and treasurer.

Plans have been completed for the rebuilding of the works of the St. Louis Steel Foundry Company at East St. Louis. These works were destroyed by fire May 17, only the pattern shop and boiler house being saved. A new equipment of machinery will be required.

W. R. Haven, who has the contract for building the new locomotive and car building shops for the New York Central at the new town of Depew, near Buffalo, has begun work on the foundations for several of the buildings. He expects to have 500 men employed in a few days.

The Chattanooga (Tenn.) Powder Company, whose plant is at Ooltewah, have commenced an addition to their works, which will double their capacity. They will put in additional machinery for the manufacture of the finest grades of powder. They are at present crowded with orders.

In connection with the redemption of over 100 acres of the Mystic River flats above and adjoining Chelsea bridge in Charlestown, Mass., the Boston & Maine Railroad proposes a new overhead iron bridge of three divisions, aggregating 1,935 feet, and costing $370,000.

The Montague & Lea Machine Tool Company has been incorporated under the laws of West Virginia, with an authorized capital of $100,000, by Wm. L. Montague, of Baltimore, and others. Extensive machine shops and foundry at Moundsville, near Wheeling, W. Va., will soon be erected.

There is water-works agitation in Anderson, Ind.; Preston, Pa; Greenfield, Mass.; New Canaan Conn; West Milton, O.; Wapakoneta, O.; Woodstown, N. J.; Shenandoah, Pa.; Lafayette, Pa.; Wyoming, O.; Woonsocket, R. I.; Altamont, N. Y.; Poughkeepsie, N. Y.; Waelder, Tex.; Wakefield Neb.

We have received a copy of the new catalogue of the Watertown Steam Engine Co., of Watertown, N. Y. It contains illustrations and descriptions of a number of styles of steam engines and boilers, stationary, portable and semi-portable, besides saw-mills, etc. It is sent, on application, to those interested.

The Waterbury Brass Co. of Waterbury, Conn., are putting up their new wire-mill, which will be of iron designed and furnished by the Berlin Iron Bridge Co., of East Berlin, Conn. The rolling-mill will be 100 feet wide by 160 feet long, with a wing (to be used for drawing wire) 40 feet wide by 230 feet long.

The Albany Steam Trap Co. have issued a new catalogue, in which is illustrated their line of steam users' goods, traps, valves of all kinds, etc. The catalogue also contains a table of steam pressures and temperatures, with other useful information, which will make it valuable to those having to do with steam plants.

Tiffany & Co., Newark, N. J., are considering plans submitted for a large factory at North Newark, to cost $1,000,000. According to the plans, the machinery in the plant is to be run by electricity, and each large machine is to have a separate motor to prevent a general cessation of work in case of a breakdown.

The Berlin Iron Bridge Co., of East Berlin, Conn., are now building a new machine shop for the Solvay Process Co., at Syracuse, N. Y. The building will be 50 feet wide by 300 feet long, and three stories high. The side walls will be of iron and brick (combination construction), with iron floors and iron roof covered with the Berlin Company's patent anti-condensation roofing.

Frank Rudolphi and Louis C. Krummel, both until recently draftsmen with the E. W. Bliss Co., of Brooklyn, the former as head draftsman, have taken steps to form a partnership and engage in the machine business in Chicago, though as yet no definite location has been decided upon. The firm name will probably be Rudolphi & Krummel, and they will start in with the building of sheet metal presses, and upright milling machines and special machinery, as their leading specialties. They are young men and highly regarded by those who know them, both as men and as mechanics.

Machinists' Supplies and Iron.

NEW YORK, June 25, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $15 50 to $16; No. 2, $14.75 to $15; Gray Forge, $13.50 to $14. Southern brands of good quality are obtainable at $14.75 to $15.50 for No. 1 Foundry; $13.75 to $14.50 for No. 2; and $12.75 to $13.50 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20.25 for Eglington.

Antimony—The market continues to decline.

We quote Hallett's, 11c; Cookson's, 14½c. to 14¼c.; and L. X., 12¼c. to 12⅝c.

Copper—The market is weak. Lake Copper can be had at 11.75c. Casting Copper is held at 11¼c. to 11¼c.

Lead—Sales have been made at 4.10c., but the spot price is nearer 4.05c. Consumers are buying as wanted. Little business is done. The outlook is steady.

Lard Oil—The market is quoted at 57c. to 58c. for Prime City. Western on spot is quoted at 56c. to 57c.

Spelter—The market is quiet. The outside figure is 4.85c. for store lots. Western smelters are firm in their views.

Tin—A reaction has set in and buyers are being favored. Sales have been 50 tons July at a decline to 21.50c., and 100 tons June at 21.60c.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—A draftsman with some machine shop experience. Address Box 93, Albany, N. Y.

Wanted—By Aug. 1, position by a foundry foreman; 30 years' exp.; best refs. Box 20, AM. MACH.

Wanted—Draftsman wishes a change; Corliss or high speed engines preferred. R., AM. MACHINIST.

Tool maker wishes engagement; 18 years' exp.; steady, sober and reliable. Box 19, AM. MACHINIST.

Pattern maker, first class, 2½ years foreman, good draftsman, first-class references, wants steady work in the West. Albert Bunting, Streator, Ill.

Wanted—Position by a young man, (32) all-round machinist—repair work preferred—or as stationary engineer; good refs. Box 21, AMERICAN MACHINIST.

Wanted—Foundry foreman, to take charge of foundry doing general work; melting, ten to fifteen tons daily. Address Box 22, AM. MACHINIST.

Wanted—Position as foreman by a thorough practical molder; 16 years' experience as foreman; reference furnished. Address Foreman, AM MACH.

Mechanical draftsman desires new position in New York or Brooklyn; shop and drafting room experience in steam engine. N. Y., AM. MACHINIST.

Wanted—Experienced draftsman for general designing; permanent situation to right man; give full particulars as to experience, and salary wanted. Address Filer & Stowell Co., Milwaukee, Wis.

Mech. draftsman and designer desires engagement; competent, reliable and energetic; 6 years' exp. in mach. shops & engineering offices on mach'y and gen. engineering. A1 refs. M. E., AM. MACH.

Wanted—A draftsman, one who is a fair mechanical engineer; steady work at a reasonable salary. State wages wanted, references, etc. The P. H. & F. M. Roots Co., Connersville, Ind.

Wanted—Three good machinists and vise and floor men; long-time job; light work; two hours' ride from Chicago. Address at once, with references and full particulars, Box H., Michigan City, Ind.

Wanted—Six experienced mechanical draftsmen; none but men familiar with modern mechanical devices need apply. Apply at Western Ave. office of Thomson Houston Electric Co., Lynn, Mass.

Wanted—By a young machinist with ability and grit, and eight years' good general experience in first-class shops, a position as foreman of small shop, or as assistant foreman; West preferred; first-class references. Address C. E. B., 534 Seymour street, Syracuse, N. Y.

✚ MISCELLANEOUS WANTS ✚

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wall Drills complete, $25. S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

Presses, Wire Form'g Mchy. Am. Tool Wks, Clev, O.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Special machinery designed and built. C. F. Langston & Co., 70 N. 4th St., Philadelphia.

Complete mach'y for mfg. horseshoe delivered by L. Ingermann, Minden, Westphalia, Germany.

PURE FEED-WATER For Steam Boilers.

THE BUNNELL FILTER AND PROCESS Furnishes Steam Boilers with water that is absolutely freed from all scale producing substances. Guaranteed or no sale.

BRADLEY & COMPANY, SYRACUSE, N. Y.

AMERICAN AND FOREIGN PATENTS.
We refer to well-known men and establishments in the machine trades for whom we have done business.
Epitome of the World's Patent Laws and Statistics Sent Free on Application.
(Registered English Patent Agent, according to Act of Parliament.)
F. W. BARKER'S PATENT AGENCY,
THE BENNETT BUILDING, 93-99 NASSAU ST., N.Y.
Monument Chambers, King William St., London, E. C., England.

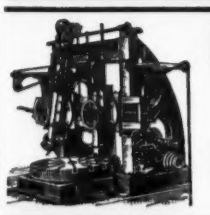
STEEL TUBES WELDLESS SMOOTH · COLD DRAWN John S. Leng's Son & Co. New York.

CALIFORNIAN AGENCIES WANTED.
Jno. A. Weir & Co., Investment Brokers, Los Angeles, Cal.
Would be pleased to correspond with manufacturers wanting first-class representative on the Pacific Coast. Correspondence solicited from any one wanting information about Southern California. Best of Detroit, Michigan, and Los Angeles, California, references.

STEAM BOILERS.
Their Construction, Strength and Economical Working.
By ROBT. WILSON and J. J. FLATHER.
"The Standard for Practical Men."
108 Illustrations, Tables, etc. 12mo Cloth, $2.50.
JNO. WILEY & SONS, NEW YORK.

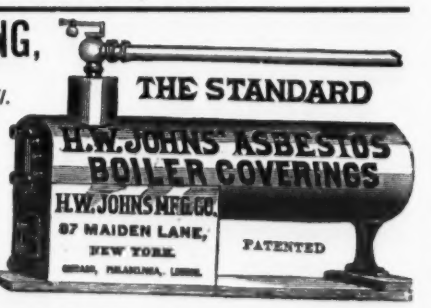
World's Fair Exhibitors ATTENTION.
Do you desire the services of a reliable company to receive, install and superintend your exhibit during the World's Columbian Exposition? We can save you money. Unexceptional references. Write for pamphlet and particulars.
CHICAGO COMMERCIAL COMPANY, 501, 502, 503 Home Insurance Bldg., Chicago.

VALUABLE FACTORY PROPERTY FOR SALE or TO RENT.
CONSISTING OF THE FOUNDRY AND MACHINE SHOPS FORMERLY OCCUPIED BY THE STILES & PARKER PRESS CO., Middletown, Conn.
The works are fitted up with line shafting, a new 100 Horse-power Boiler, 3 Engines, Cranes, Blower and Cupolas in Foundry, Blacksmiths' Forges and Steam Hammer, Automatic Sprinkler System, Gas Machine, all in first class condition. Large enough for 100 to 200 hands. Located on the Connecticut River, in direct communication with Hartford and New York by freight boats, and with New York, Boston, and all other points by the Connecticut Valley R. R., the "Air Line," and the N. Y., N. H. & H. R. R. For particulars apply to
E. W. BLISS CO., LTD., No. 1 ADAMS ST., BROOKLYN, N. Y.



BORING AND TURNING MILLS
COMBINING EVERY IMPROVEMENT.
14 SIZES—FROM 5 TO 20 FEET.
BETTS MACHINE COMPANY, WILMINGTON, DEL.

ASBESTOS CEMENT FELTING,
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.
We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.
H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.



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Stolpe's Universal Punch is new and the best: write for circular. Stolpe, 154 W. 27th St., N. Y.

Design & superintendence of mach'y. Drawings, etc., made. Claud Mantle, 598 E. 134th St., N. Y.

George D. Slade, dealer in molding sand of all grades, Waterford, N. Y.

Wanted—A specialty to manufacture either heavy or light work. We have splendid facilities. Address "Manufacturers," Rockford, Ill.

Wanted—Hardware specialties to build. Send 25 cents for "Eureka Knife and Shears Sharpener." W. A. Smith & Co., 227 Eddy Street, Providence, R. I.

Inventors desiring additional skill in drafting, perfecting, patenting, building, or marketing devices of merit, address C. A. J., AM. MACHINIST.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Bound volumes for 1891. We are now prepared to take orders. Price, $4.00 per volume; express charges payable by purchaser. Address AMERICAN MACHINIST, 203 Broadway, New York.

I have several valuable improvements thoroughly tested in the metal line, embodied in two U. S. patents for sale for cash or on royalty. Address BOX 23, AMER. MACHINIST.

For Sale—In Central Pa., a well equipped machine shop, with orders entered for 3 months' work; owner desires to devote time to other business. Price, $4,000. Address P. O. Box 27, Harrisburg, Pa.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 25, 1886, issue; must be unsoiled and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

For Sale—Near N. Y. City, splendid equipment medium size mach. shop. Best substantial modern lathes, planes, etc., for eng. & gen. work. Splendid ass't of taps, etc., & some valuable pat. Doing good local business. Price $8,000. A. B., AM. MACH.

Machine Tools in Stock.

ENGINE LATHES.

82 in. swing,	34 ft.	bed.			Whittier
78 do	9 ft.	between centers			Sellers
38 do	17 ft.	bed.	New		Fifield
30 do	14	do	do		do
27 do	16	do	do		Fifield
24 do	12	do	do		Fitchburg
24 do	12	do	do		Flather
22 do	10	do	New Pattern		Fifield
22 do	12	do	do		do
22 do	12	do	New		Blaisdell
22 do	8	do	do		Flather
22 do	10	do	do		do
20 do	8	do	do		do
20 do	10	do	do		do
18 do	8	do	do		do
18 do	10	do	do		do
18 do	8	do	do		Blaisdell
18 do	16	do	do		do
16 do	6	do	do		Flather
16 do	6	do	do		Blaisdell
15 do	6	do	do		Flather
14 do	6	do	do		do
14 do	6	do	do		Blaisdell
12 do	6	do	do		do

PLANERS.

42 in. wide,	42 in. high,	12 ft.	long, 2 heads	Gleason
36 do	36 do	8	do	Pease
30 do	30 do	8	do	do
30 do	30 do	8	do	Whitcomb
30 do	30 do	8	do	Flather
26 do	26 do	6	do	do
24 do	24 do	6	do	do
24 do	24 do	6	do	Whitcomb
22 do	22 do	5	do	do
22 do	22 do	6	do	Flather

SHAPERS.

12, 16, 20 and 24 inch stroke	Eberhardt
15 and 24 inch stroke	Hendey
32 inch stroke with key-seating attach.	Walcott

UPRIGHT DRILLS.

20, 21, 25, 28, 30 and 36 inch swing	Prentice
20, 23, 25, 28 and 34 inch swing	Blaisdell
60 inch swing Radial Drill	Baush

HILL, CLARKE & CO.,
156 OLIVER ST., BOSTON, MASS.

TO LET.

The Engine Works at Newburgh, N. Y., at present occupied by Wm. Wright, is offered to let from May 1st, 1892.

The Property consists of

MACHINE SHOP, FOUNDRY, BOILER, FORGE AND PATTERN SHOPS, with a full equipment of tools.

The works are located in the heart of the city, and convenient to railroad and river transportation.

For terms, apply to

HOMER RAMSDELL,
NEWBURGH, N. Y.

Second Hand and New Machinery ON HAND.

10 ft. x10 ft. x16 ft.	Planer.	1 Head.			
72 ft. x48 ft. x21 ft.	do	3 Heads, Detrick & Harvey, new.			
62 in. x48 in. x17 ft.	do	1	do		
54 in. x48 in. x12 ft.	do	2	do		
54 in. x42 in. x24½ ft.	do	2	do		
46 in. x33 in. x30 ft.	do	2	do		
42 in. x4 in. x 8 ft.	do	1	do		
39 in. x36 in. x12 ft.	do	1	do		
36 in. x36 in. x10 ft.	do	1	do		
30 in. x30 in. x7 & 8 ft.	do	1	do		
26 in. x26 in. x6 ft.	do	1	do		
25 in. x24 in. x6 ft.	do	1	do		
22 in. x21 in. x5 ft.	do	1	do		
96 in. Raising Blocks to 13 ft. x36 ft. Bed Engine Lathe.					
50 in. x30 ft. Bed Tripie Geared.			New	do	do
48 in. x22 ft.	do		do	do	do
42 in. x17 ft.	do		Al	do	do
32 in. x12, 14, 16, 18 ft.	Bed.		New	do	do
28 in. x12, 14, 16, 18 ft.	do		do	do	do
21 in. x10, 13 ft.	do		do	do	do
20 in. x 7½ & 8 ft.	do		2d Hand	do	do
18 in. x 6, 7 & 8 ft.	do	New &	do	do	do
17 in. x 8 ft.	oo		do	do	do
16 in. x 6 & 8 ft.	do	do	do	do	do
15 in. x 6 & 8 ft.	do	do	do	do	do
14 in. x 6 ft.	do	do	do	do	do

2,000 lb. Bement Steam Hammer.
Car Axle Lathe Bement.
9 & 14 in. Stroke Slotters.
15, 16, 18, 25 in. Crank Shapers.
20, 24, 26 & 30 in. Geared Shapers.
20, 22 24, 28, 30 & 36 in. Drills.
Bolt Cutters.

GEO. PLACE MACHINE CO.,
120 BROADWAY NEW YORK.

SPECIAL INDUCEMENTS IN SECOND-HAND MACHINERY.

ENGINE LATHES.

1 18 in. x8 ft. Worcester, Rod Feed, Plain Rest.	Good order.
1 16 in. x6 ft. Hatfield, Rise and Fall Rest, H. S.	Good as new.
1 15 in. x6 ft. Blaisdell, Rise and Fall Rest, Chuck and Tools.	Al condition.
1 15 in. x6 ft. Windsor Elevating Rest, 2 Chucks.	Good as new.

PLANERS.

1 22 in. x22 in. x5 ft. N. Y. S. E. Co.	Al condition.
1 22 in. x22 in. x5 ft. Whitcomb.	Good as new.

DRILLS.

1 20 in. Wheel Feed, Quick Return.	Good order.
1 No. 2, 3-Spindle Garvin Elevating Table.	
1 No. 4, 6-Spindle Garvin " "	
1 4 Spindle Pratt & Whitney " "	

These Drills are in Al Condition.

MISCELLANEOUS.

2 Jones & Lamson's Small Screw Machine, wire feed.	Al condition.
1 Brown & Sharpe No. 2 Screw Machine, W. F.	Good as new.
1 Jones & Lamson No. 2 Turret Lathe	Al condition.
2 No. 1 Garvin, W. F. Screw Machines,	Good as new.
1 Brown & Sharpe Plain Miller, No. 2.	" "
1 No. 2 Garvin "	Al condition.
1 Brown & Sharpe Surface Grinder.	" "

Power Presses, Screw Slotters and Tapping Machines.
Write for list of 400 new and second-hand machines ready for delivery.

THE GARVIN MACHINE COMPANY,
LAIGHT AND CANAL STS., NEW YORK.

ALUMINUM!

THE COWLES ELECTRIC SMELTING & ALUMINUM COMPANY,
Lockport, - New York,

Offer Pure Aluminum in Ingots, Slabs, Sheet, Wire and Castings at lowest market rates.

Aluminum Bronze, Aluminum Brass, Silver Bronze, Silicon Bronze and Manganese Bronze.

JESSOP'S STEEL

FOR TOOLS, DRILLS, DIES, &c.

ALL KINDS IN STOCK.
Manufactory, SHEFFIELD, ENG.
Chief Am. office, 91 JOHN ST., N. Y.
WM. JESSOP & SONS, LD.

VANDERBEEK'S
TRADE MARK.

MILLING MACHINE.
FIVE STYLES.
THE STATES MACHINE CO.,
HARTFORD, CONN.

CUTS FASTER THAN ANY OTHER TOOL ON EARTH
WRIGLEY'S EMERY WHEEL DRESSER
T. WRIGLEY PAT. JUNE 17, 1890.
No 1
NEVER GETS DULL.
SEND FOR CIRCULAR.
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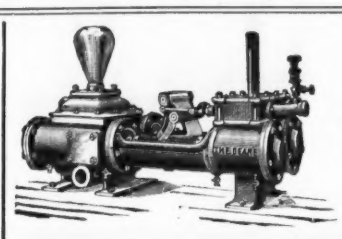

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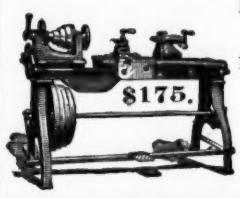

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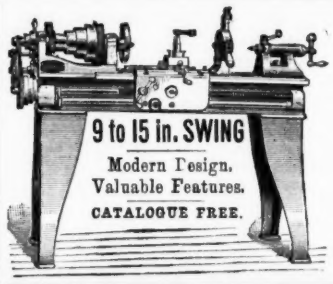

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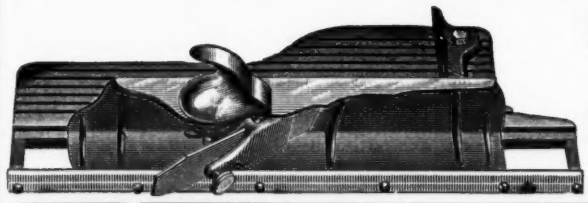

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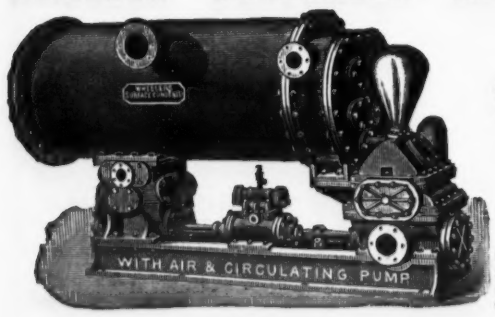

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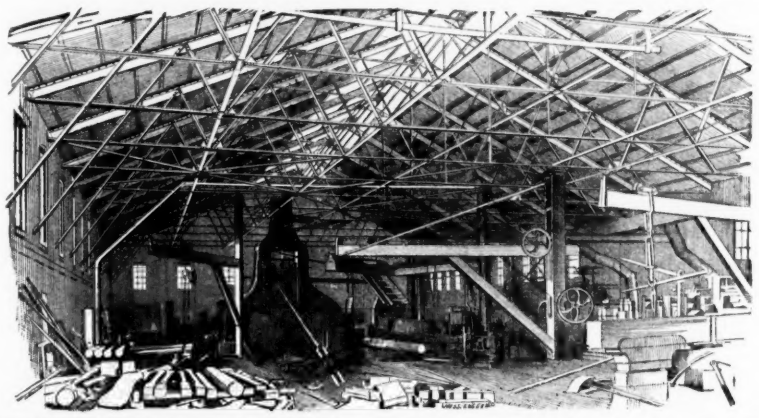

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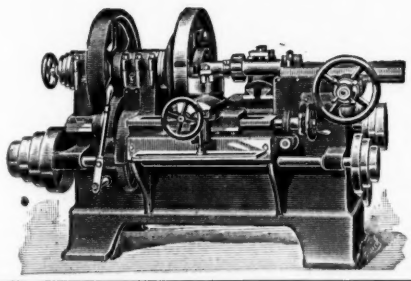

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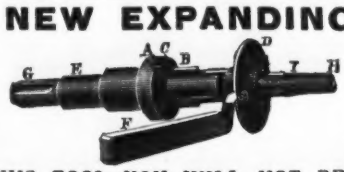

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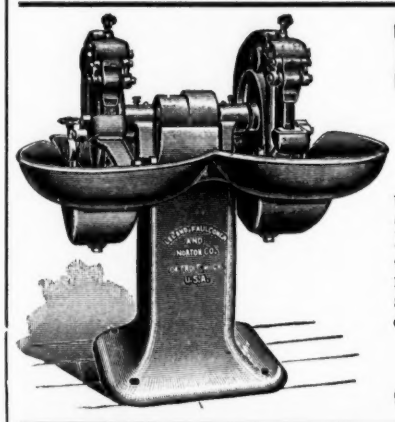

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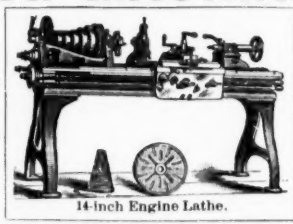
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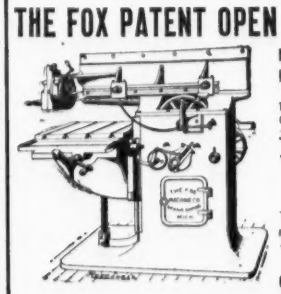

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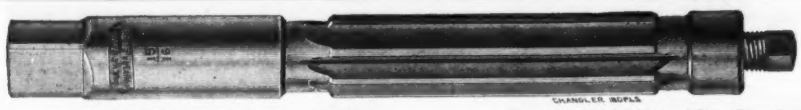

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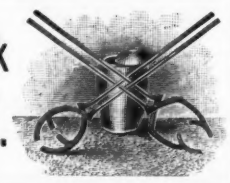

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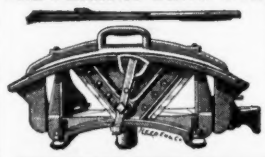

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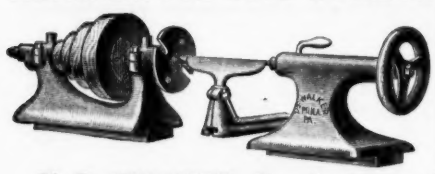

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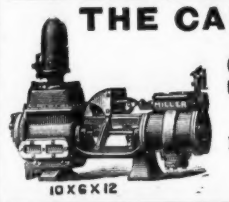

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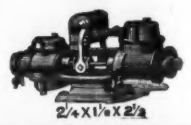

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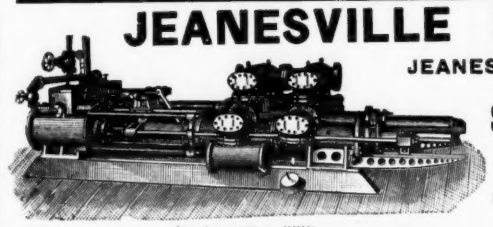

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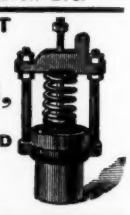

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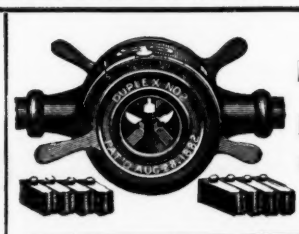

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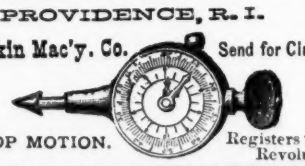

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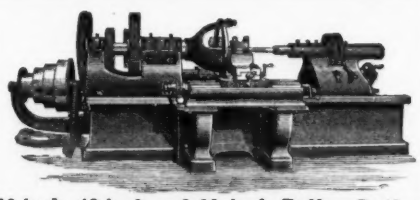

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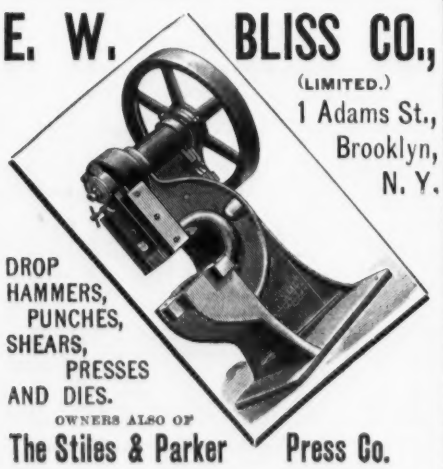

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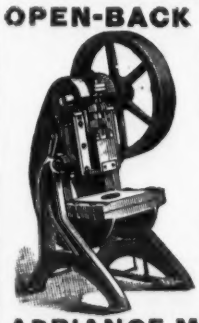

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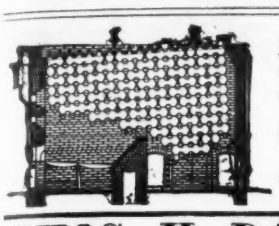

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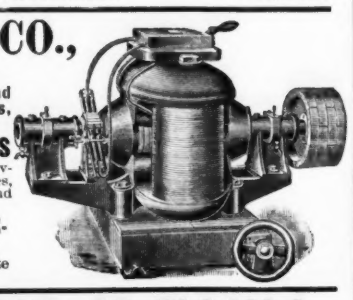

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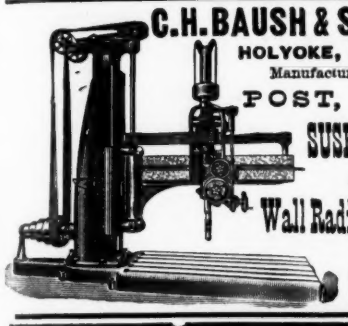

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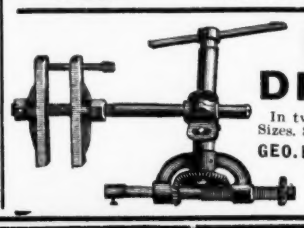

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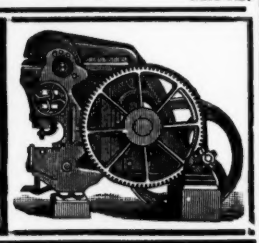

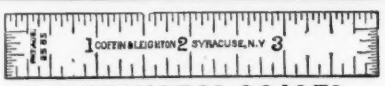

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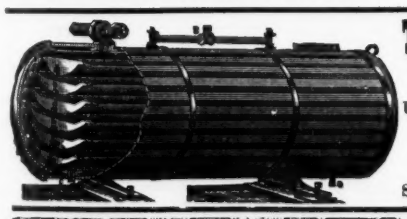

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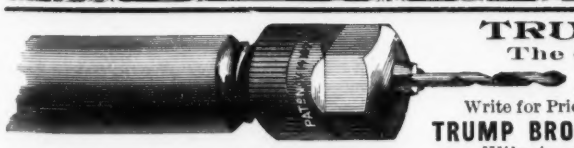

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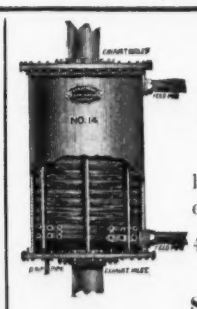

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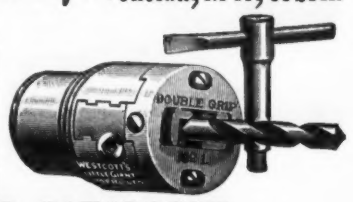

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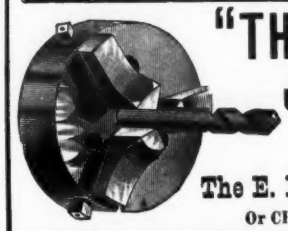

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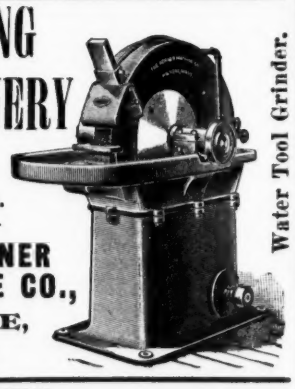

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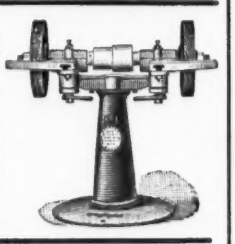

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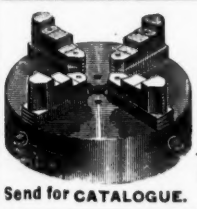

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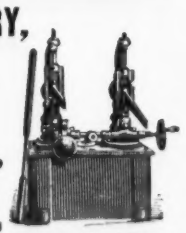

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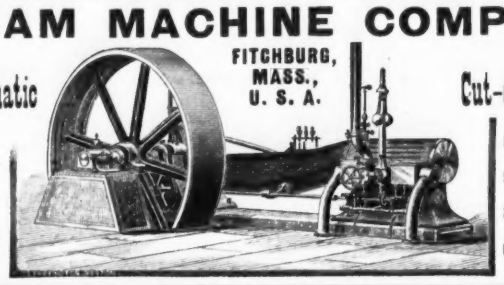

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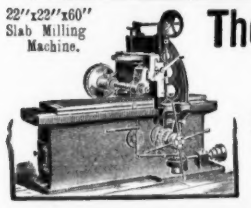

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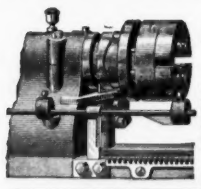

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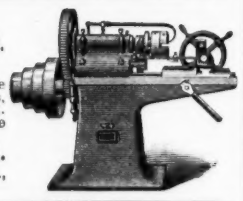

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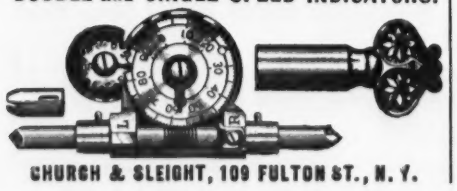

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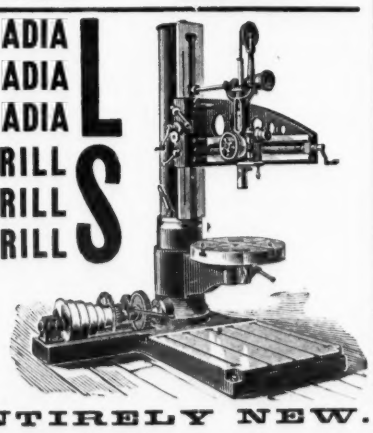

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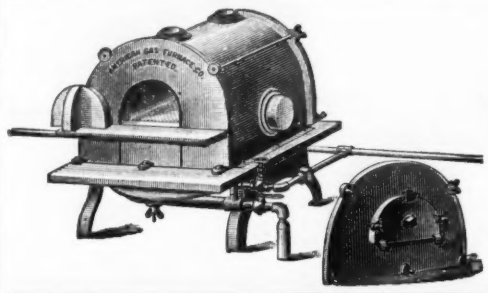

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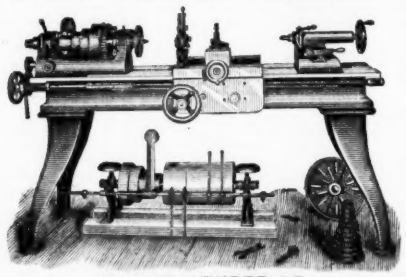

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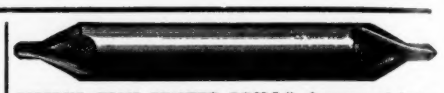

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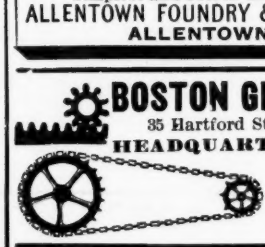

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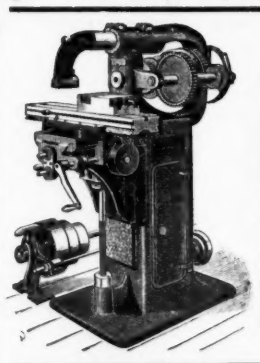

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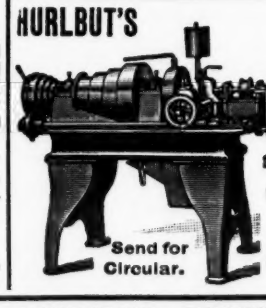

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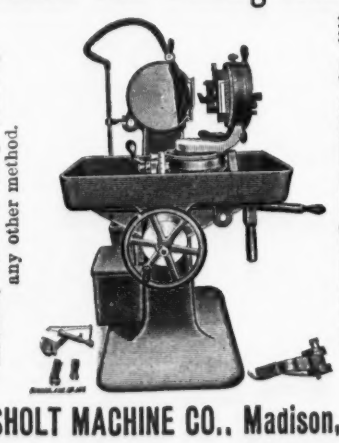

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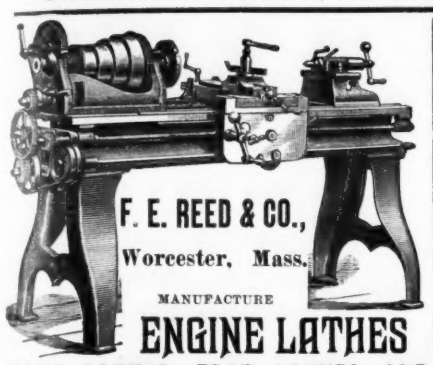

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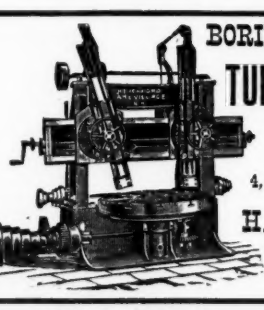

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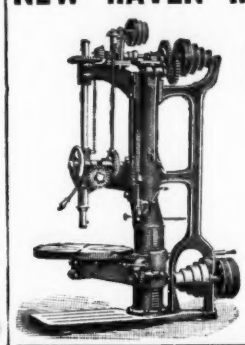

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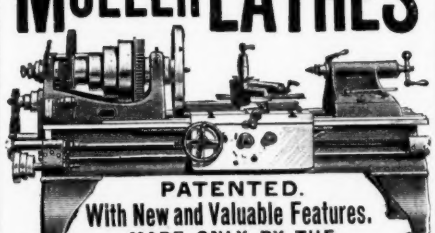

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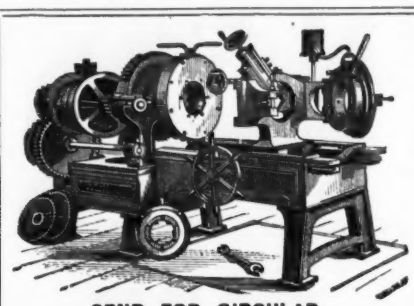

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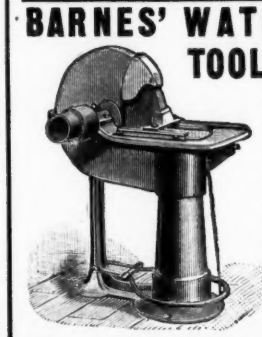

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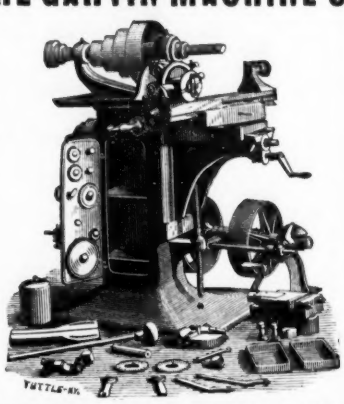

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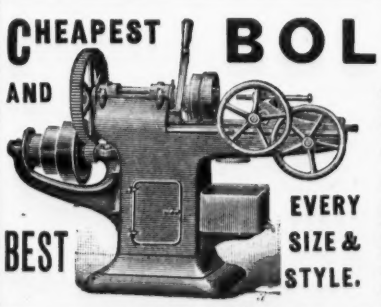

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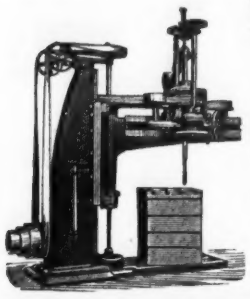

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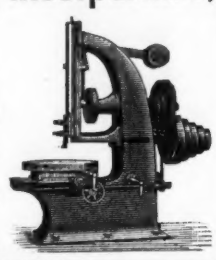

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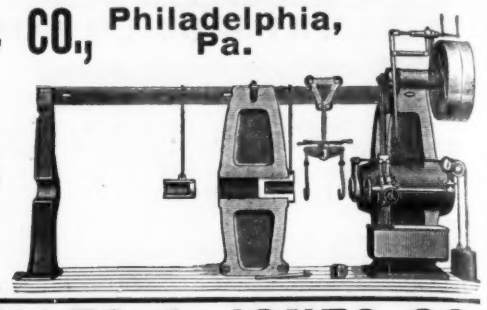

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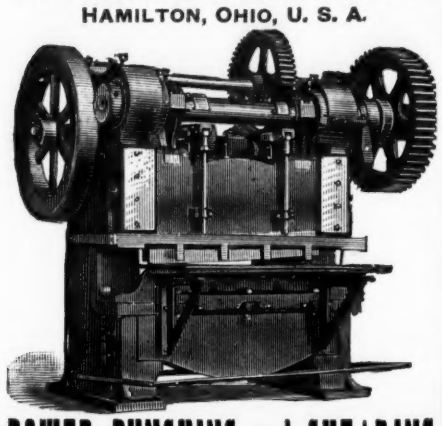

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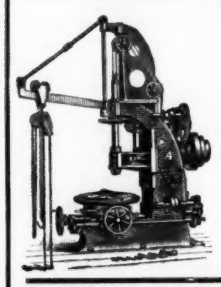

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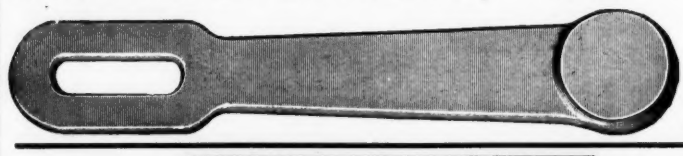

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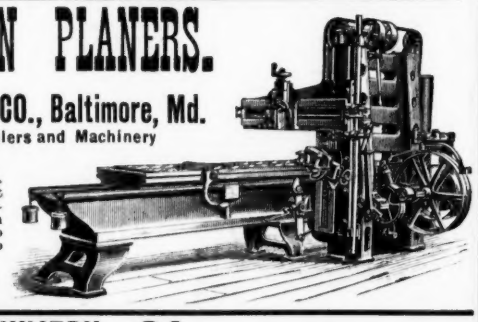

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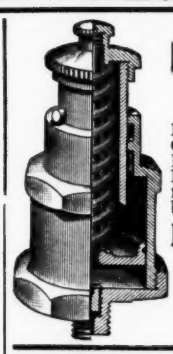

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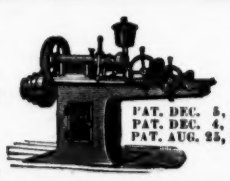

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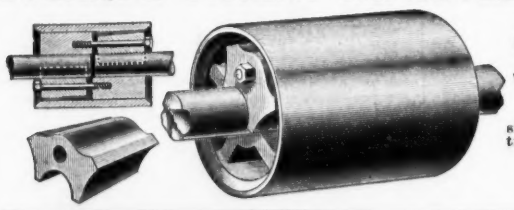

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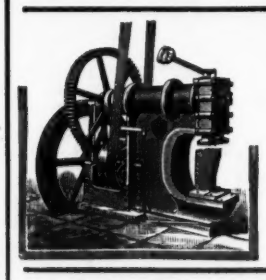

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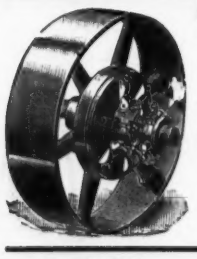

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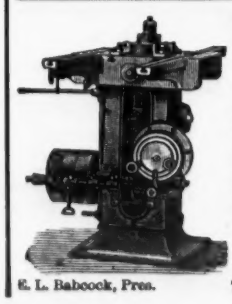

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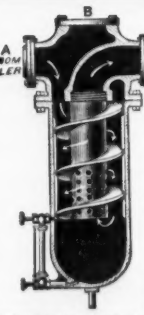

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Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or B, as convenience may require; also used in conveying steam long distances, for Steam Hammers, Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.
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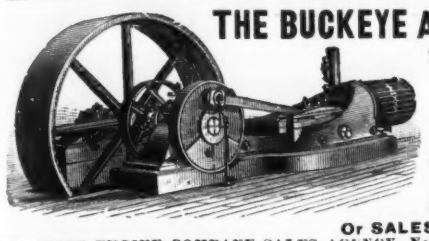

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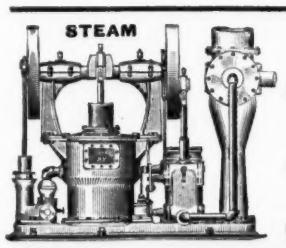

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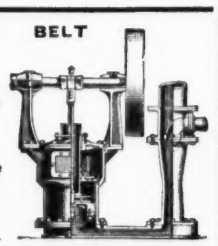

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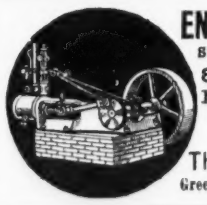

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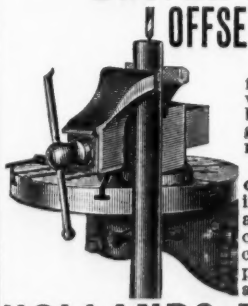

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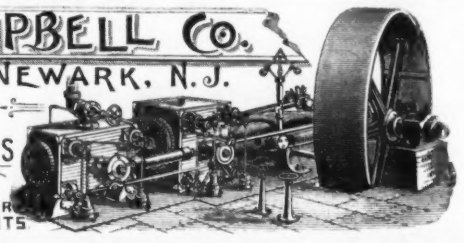

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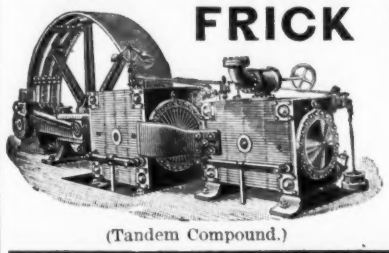

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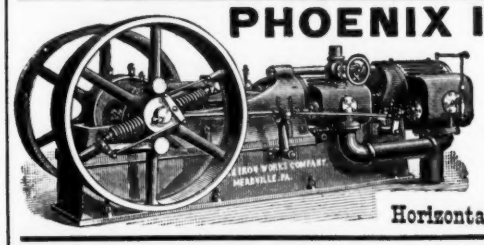

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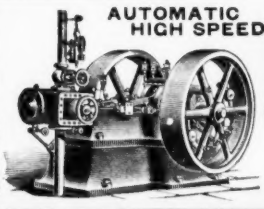

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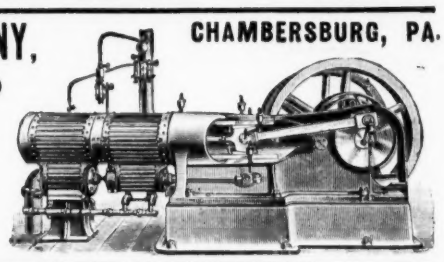

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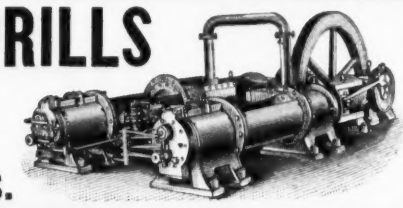

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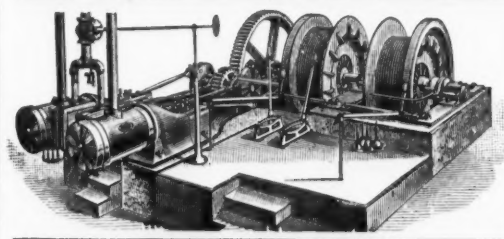

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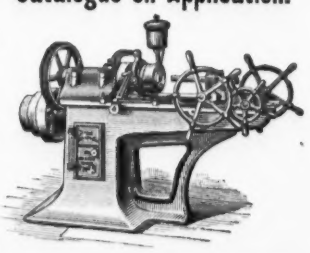

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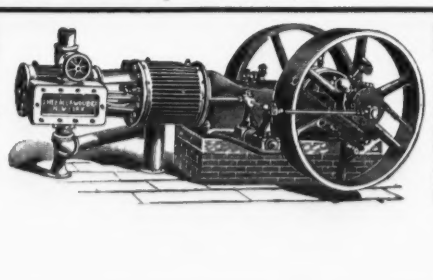

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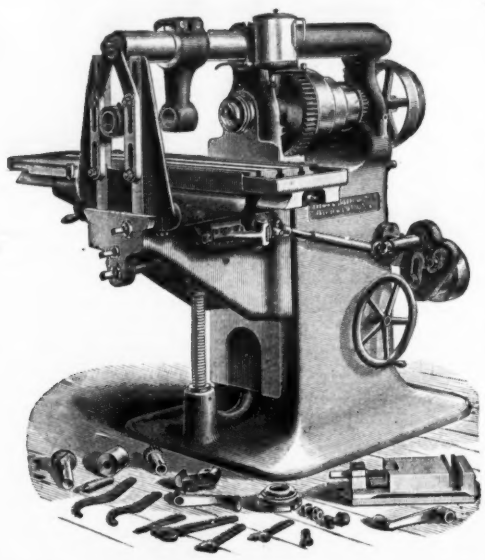

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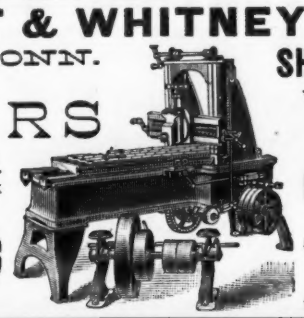

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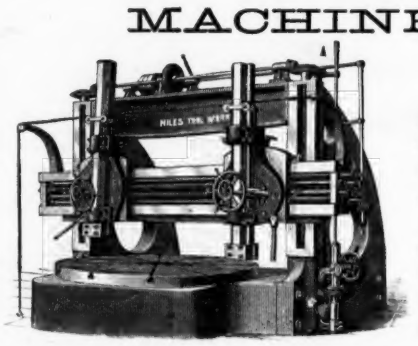

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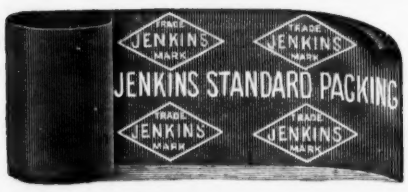

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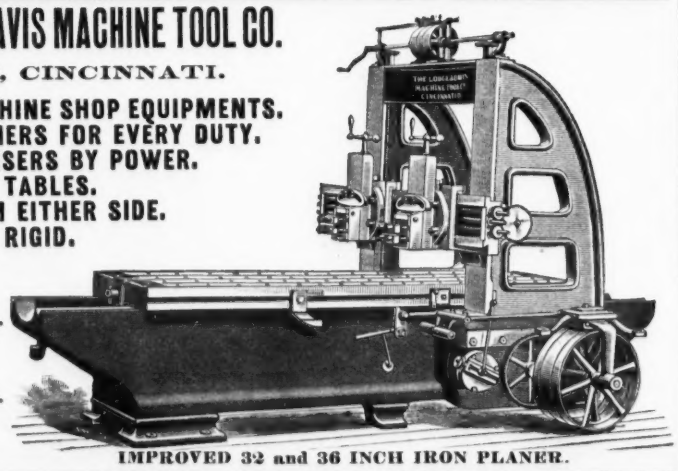

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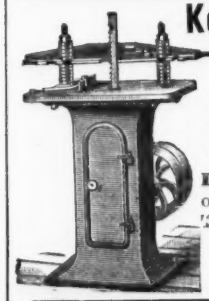

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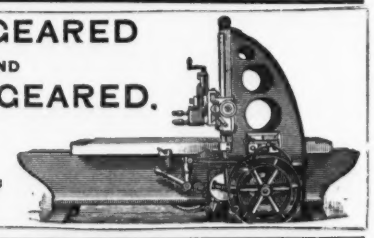
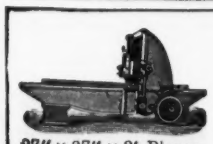
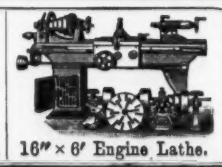
479 Sycamore St., CINCINNATI, O.





37″ × 27″ × 8′ Planer.

20″ × 6′ Chucking Lathe.



16″ × 6′ Engine Lathe.

25″ Pillar Shaper.
CHAS. CHURCHILL & CO., Agts.
21 CROSS ST., Finsbury, London, Eng.

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MANUFACTURERS OF MACHINE TOOLS. SEND FOR OUR CATALOGUE.

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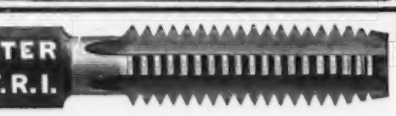

Manufacturer —of— TAPS & DIES